USAID PES SOURCEBOOK

LESSONS AND BEST PRACTICES FOR PRO-POOR PAYMENT FOR ECOSYSTEM SERVICES

OCTOBER 2007

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The USAID PES Sourcebook was prepared for USAID by the SANREM and BASIS CRSPs through the Global Assessment of Best Practices in Payments for Ecosystem Services Programs project. The views and opinions of the authors expressed herein do not necessarily state or reflect those of the United States Government.

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Sustainable Agriculture and Natural Resources Management CRSP
Office of International Research, Education, and Development
Virginia Tech
526 Prices Ford Rd,.Blacksburg, VA 24061
Phone: 540-231-6813
Fax: 540-231-1402
Email: sanrem@vt.edu
On the web: www.oired.vt.edu/sanremcrsp/

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INTRODUCTION

This Sourcebook focuses on conceptual and design issues related to payments for environmental services (PES), in the form of a loose-leaf three-ring binder. The information can also be downloaded so that updates and changes can easily be added over time without the need to republish the whole thing. We use a broad perspective on "payment": Depending on the context, it could imply either cash or noncash incentives, rewards or compensation. The Sourcebook is meant to serve as both a ready reference and a repository of useful knowledge on PES. Because it is meant for managers and practitioners, it is not dense or technical.

The Sourcebook consists of a series of briefs on selected topics. The briefs include practical examples and graphics to explain various concepts. The aim is to make each brief a stand-alone document so that practitioners can directly access a particular section without necessarily reading all the earlier sections. At the end of many briefs, further relevant readings are suggested. It will be helpful, however, to start with Brief 1, "Basic Principles of PES," which provides an overview of the concept of payments for environmental services.

The next section comprises five briefs, numbered 2.1 through 2.5, describing major environmental services. It includes definitions of technical terms and relevant examples. The first four briefs describe payments for different types of services: carbon sequestration, watershed services, biodiversity conservation, and scenic beauty. Each addresses the nature of a service and the scale over which it is provided, why it might lend itself to a payment approach, and some enabling technical and institutional factors. The fifth brief focuses on bundling multiple services into a single contract.

The next five briefs, numbered 3.1 through 3.5, address the practical aspects of payments for environmental services: how to go about designing and implementing a PES scheme. The first brief describes buyers, sellers, and intermediaries, who are the three prominent stakeholder groups that interact in PES programs. The second brief discusses various techniques to set a value on environmental services. The third addresses forms of payments being offered and the contractual obligations of service providers on which those payments are conditional. The fourth brief discusses ways of reducing transaction costs associated with PES, and the fifth, drawing on the first four, discusses the compatibility between securing environmental services and alleviating poverty.

Following are journal and research articles on evaluating the impact of PES programs (Brief 4), important policy and institutional issues (Brief 5), alternatives to the PES approach (Brief 6), and a synthesis of regional reviews of Payments for Watershed Services in Asia, Africa, and Latin America (Brief 7). The different studies and papers quoted in various briefs are listed as references.

The appendices comprise an overview of the online Payments for Environmental Services Knowledgebase; regional synthesis working papers on PES efforts in Africa, Asia, and Latin America; and a supplemental reading list.

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BASIC PRINCIPLES OF PES

USAID PES Brief 1

Authors

Rohit Jindal and John Kerr[1]

Introduction

The city of New York receives most of its water from the Catskill-Delaware watershed. In the 1990s, a new federal water quality standard would have required the city to set up a filtration plant at an estimated cost of $4 billion to $6 billion. Instead, in 1997, the city entered into an agreement with farmers in upstream communities to undertake a conservation easement and forestry program to protect environmentally sensitive parts of the watershed. Since then, this watershed protection agreement has helped to improve the quality of drinking water while saving the city more than $1 billion.

Similarly, the Ministry of Environment in Costa Rica operates a nationwide program under which forest owners receive payments for providing four particular environmental services: carbon sequestration, biodiversity protection, watershed management, and maintaining landscape beauty. The Ministry in turn sells some of these services to international investors while helping to add precious forest cover in the country.

In these examples, upstream farmers in New York and local landowners in Costa Rica are seen as providers of useful environmental services for which they receive payments from the service buyers (service beneficiaries or "users"). Over the last decade, several such schemes have evolved. Known as Payments for Environmental Services (PES), these approaches constitute a new frontier in conservation and sustainable development efforts. Valid questions that arise here are: What is so new about PES, and what makes it special? We answer these questions by discussing why it is generally difficult to encourage natural resource users to provide environmental services and the relative merits of PES compared with other approaches to promote conservation.

Market failure and PES

Environmental services are often underprovided by markets due to three interrelated characteristics: externalities, non-excludability, and intangibility. **Externalities** exist when the activities of one person affect the welfare of others who have no direct control over them. For instance, when upstream landowners cut trees, it may lead to flooding (a harmful or negative externality) in downstream areas. However, the landowner may consider only the private timber benefit without accounting for the social damage due to flooding. We are usually concerned about negative externalities, but there can also be beneficial (positive) externalities. An upstream land use associated with reduced erosion downstream is a positive externality.

[1] Department of Community, Agriculture, Recreation, and Resource Studies, Michigan State University

Non-excludability refers to the difficulty of excluding people from consuming a resource even if they do not pay for it. Forests absorb carbon dioxide from the atmosphere and release oxygen, the benefits of which are available to all, irrespective of who planted the trees. Thus when a resource is non-excludable, people tend to "free ride" or benefit from it without paying for its upkeep. This may result in underinvestment in the resource.

Finally, the flow of environmental services often is not apparent. For example, even though aquifers are interconnected, it is often difficult for communities to establish a causal relationship between conservation efforts in one part of the watershed and availability of groundwater in another. This **intangibility** reduces the users' willingness to pay for the upkeep of the resource.

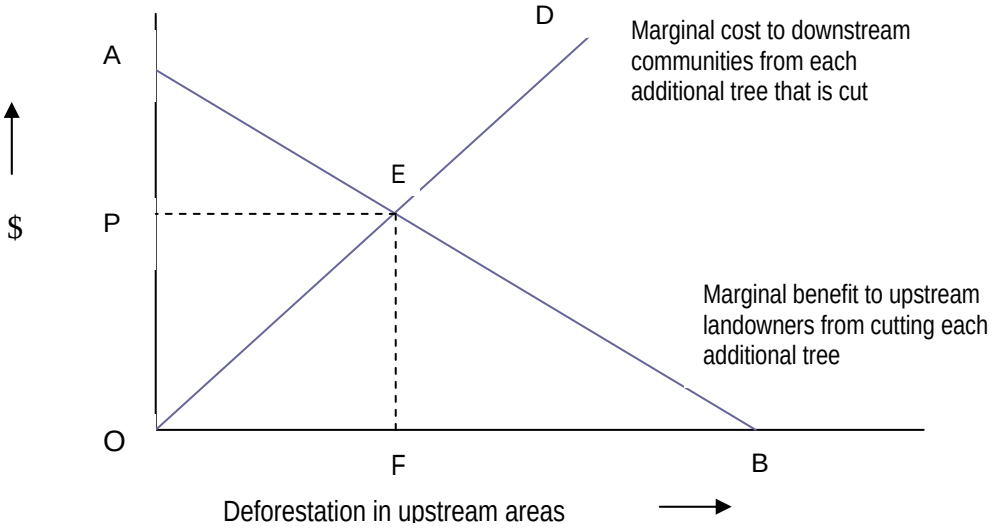
Historically, because many environmental services were not under threat, people took them for granted. As they became scarce, governments took steps to ensure their provision through command-and-control measures such as imposing local land use regulations or establishing nature protection areas. Similarly, in many countries farmers were required to invest in measures that were thought to conserve natural resources, like planting trees or building soil conservation structures. However, governments lack sufficient funds to secure all environmental services, and national priorities may differ from local priorities, ultimately affecting which resources are conserved.

Local communities often organize collective action around environmental services that are valuable to them. In this regard, examples of *Van Panchayats* (local forest councils) in India and the Subak irrigation system in Indonesia are well documented (Ballabh and Balooni, 2002; Lansing, 1987). However, such locally initiated collective action is not always forthcoming and does not normally focus on environmental services of value beyond the local community.

Another conservation approach that has been tried is known as Integrated Conservation Development Programs (ICDPs). These programs aim to create economic opportunity for local people alongside conservation of globally valuable resources, typically biodiversity including wildlife. They may include job training, infrastructure, and other investments in the local economy. The objective is to build a better relationship between local people and conservation authorities, and to overcome weaknesses of "fines and fences" approaches that were based on an adversarial relationship in which authorities tried to protect valuable natural resources from local land users. A major problem with this approach is that economic incentives are indirect and not linked to specific conservation outcomes. In other words, local people gain the economic incentives whether or not they protect the resources. In addition, in some cases strengthening the local economy simply increased the pressure on scarce natural resources. Overall, such programs were not effective in securing an environmental service.

PES, on the other hand, is a direct approach to conservation whereby service providers receive payments that are conditional on acceptable conservation performance. Although researchers usually point out other features to PES, such as that the payment should entail a voluntary transaction between at least one provider and one user for a well-defined environmental service, conditionality is the characteristic that most distinguishes PES from previous approaches.

The theoretical foundations of PES lie in the principle of mutually beneficial bargaining, as suggested by economist Ronald Coase. Through such bargaining, two parties may arrive at an adequate allocation of an environmental resource that is socially efficient (see chart, following page).



Mutually beneficial payment system between two parties

In the diagram, line AB represents the marginal benefit to upstream landowners from cutting each additional tree. The marginal benefits are declining, perhaps due to a lower price for timber as more reaches the local market or because the highest-quality trees are cut first. In this simple example ignoring the costs of harvesting trees, landowners will keep deforesting the area as long as their marginal benefits are positive, i.e., up to point B. However, as more trees are cut, downstream users face costs of flooding and increased sediment flow, represented by line OD. These marginal costs increase as more trees are cut. The two lines intersect at point E, where the marginal benefit for upstream landowners is equal to marginal cost for downstream users. To the right of point E, the marginal cost for downstream users is more than the marginal benefit for upstream landowners. Therefore, the two parties can negotiate a deal whereby downstream users pay price P to upstream landowners for each tree that is *not* cut. Note that price P is mutually beneficial for both parties. Through this payment, they achieve the socially efficient point E where the deforestation level, F, is much less than the privately determined deforestation level B. This in essence is the rationale for PES programs.

Repeatedly pointed out by Coase himself and in subsequent literature, however, is that this bargaining is difficult to achieve in the real world due to high transaction costs, especially given the existence of multiple parties affected by an environmental service. Transaction costs refer to costs of negotiating a contract, implementing a payment scheme, and monitoring and measuring changes in the level of the environmental service in question. As more parties are involved in a payment scheme, transaction costs tend to escalate. Until recently, high transaction costs thwarted any attempts to address externality and non-excludability in environmental services through direct contacts. However, newer institutional and technical innovations have helped to scale down transaction costs considerably. In the case of carbon sequestration for example, on the institutional side, establishment of carbon markets like the Chicago Climate Exchange facilitate carbon trading without requiring buyers and sellers to search for each other. On the technical side, science can now determine much more accurately (and relatively inexpensively) the amount of carbon dioxide sequestered by specific stands of trees, so that one country can sell carbon sequestration rights to another.

Prominent environmental services

Forests and natural ecosystems provide several kinds of environmental services, such as storm protection by mangrove forests, erosion control, pollination of crops, abatement of noise pollution, maintenance of air quality, and scenic beauty. However, not all of these are directly marketable, either because they are not perceived as valuable enough or due to economic and technical constraints as described above. It is useful to note that PES can help in securing only those environmental services for which environmental service users are willing to pay. To date, the four most common services found in developing country PES schemes are:

Carbon sequestration. Forests absorb (or sequester) significant amounts of carbon dioxide from the atmosphere, which helps in mitigating global warming. Many governments, corporations, and even individuals are willing to pay landowners and communities to adopt land-use practices that promote carbon sequestration.

Watershed protection. Ecosystems such as wetlands and forests regulate hydrological flow and control soil erosion. Better management of agricultural chemicals protects water quality. As clean water becomes scarce and people are more concerned about its quality and quantity, downstream consumers (e.g., hydropower plants, water utilities, irrigators and other downstream farmers, fishermen, and aquaculture.) in some places are willing to pay upstream land users for watershed services.

Biodiversity conservation. A significant proportion of the world's biodiversity exists in tropical forests and other threatened ecosystems, but local people often cannot directly benefit from it. Some agricultural practices are more compatible with local biodiversity than others, and small payments to land users might make them sufficiently profitable to replace practices that destroy biodiversity. Several companies and international non-governmental organizations (NGOs) now support biodiversity conservation through PES.

Scenic beauty. Natural areas provide aesthetic beauty, which is treasured by most human societies. Local land-use practices can enhance or destroy scenic beauty, affecting local quality of life and affecting nature-based tourism opportunities. Tourism companies and even private foundations are paying local farmers or other landowners to preserve this valuable environmental service.

Conditionality, additionality, leakage, and permanence

As explained earlier, PES is distinct from other conservation approaches because any economic rewards to environmental service providers are conditional on their continued performance. This **conditionality** means that service providers are to receive payments only when their efforts produce detectable changes in the quality or quantity of the service. This is very different, for example, from programs that subsidize farmers to construct solid conservation or plant trees without any way to ensure that the investments are subsequently maintained. The International Small Group and Tree Planting Program (TIST) pays farmers in Uganda and India to grow trees for carbon sequestration services. Payments are linked to the number of trees protected; whenever a tree is cut, the farmer loses a portion of the payment.

Another important feature of PES and other conservation approaches is **additionality**, which requires that the payment should yield environmental benefits that would have not have been realized without it. If a landowner were not going to cut her trees anyway, it would be unnecessary and therefore inefficient to pay her not to cut them.

Leakage happens when a landowner receiving a payment simply shifts the activity that causes the environmental problem to another piece of land that is not under contract. Under such conditions there is

no additionality and thus no point in making the payment, and it would be socially inefficient. Critics of payment schemes like the national PES program in Costa Rica say that many PES programs do not achieve additionality. The solution lies in better targeting of service providers and better monitoring.

Permanence refers to the sustainability of the environmental service. Users are interested in the long-term supply of the service, which requires making payments to providers on a continued basis. For some environmental services such as carbon sequestration, permanence has a different meaning. If the environmental service is discontinued, not only is the service no longer available, but all historic supplies of the service are invalid. For example, when a tree is planted, it continues to sequester carbon as it grows. If it is cut, however, this not only disrupts the present supply of carbon sequestration but also results in emission of all the carbon that the tree ever captured in its trunk and branches back into the atmosphere as carbon dioxide.

Types of payments

In general, payments can be made in cash or noncash incentives. In fact, many people argue that the term "payment for environmental services" should be replaced by "rewards for environmental services" or "compensation for environmental services," reflecting the idea that payments need not be in cash. For this Sourcebook, we use "payment for environmental services" as shorthand to cover all kinds of arrangements that directly provide natural resource managers a conditional incentive for environmental services.

Depending on the local context and institutional arrangements of a particular program, payments can take several forms, including individual or group payments, or non-cash rewards such as tenure rights, employment opportunities, economic development investments, or access to government services. For non-cash rewards, care must be taken that conditionality is maintained, i.e., that the reward can be withdrawn if the environmental service is no longer supplied. Intermediaries may select group payments or provide local infrastructure development with a view to reduce transaction costs of dealing with individual service providers. However, community payments can introduce other kinds of transaction costs associated with organizing the individual members into a cohesive group and ensuring that all members receive their fair share. In addition, some noncash payments such as land tenure security may be difficult or impossible to revoke if the environmental service is no longer supplied.

PES and poverty alleviation

PES programs are often perceived as tools for poverty alleviation. Indeed, many potential service providers are poor people who depend directly on natural resources for their livelihoods. Any economic incentive to them for improving an environmental service might represent additional income and a potential for poverty alleviation. For example, in the Nhambita Community Carbon Project in Mozambique, carbon sequestration payments represent a significant portion of cash income for poor households (Jindal, 2004). Many donors and government agencies now insist that PES programs include poverty alleviation components to the extent that many such projects aim primarily to improve the economic well-being of the service providers. It is important to keep in mind that, while there may be many cases in which environmental and poverty alleviation goals are compatible, there are others where they are not. If the environmental objective is not achieved, the program may be unsustainable because environmental service users may decline to pay for a program that does not deliver what they are paying for.

Realistic expectations for attainment of environmental services

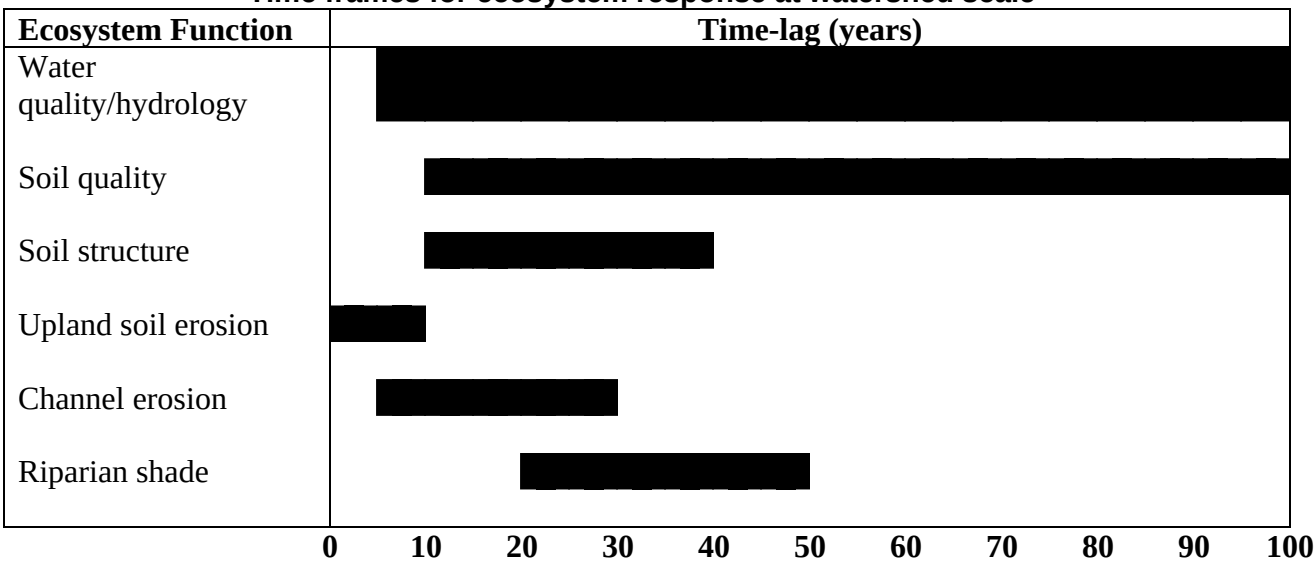
The goal of PES is to create sustainable programs for the provision of environmental services that compensate service providers and secure desired environmental services for service buyers over the long term. When considering, planning, designing, or implementing such a program, it is essential that all program participants have realistic expectations concerning the time that may be required to achieve the desired environmental services. If time lags are too great between payments from service buyers and the receipt of environmental services by the payers, then the payers may decide that the investment is not feasible and pursue more immediate and cost-effective solutions. This time lag between restoration activities and attainment of environmental services can be substantial and may range from months to years to decades or longer depending on the particular location, environmental service, and level of intervention. For example, the Kyoto Protocol is designed to reduce global carbon emissions and to sequester carbon in an effort to slow and perhaps reverse global warming trends. Actions are being implemented now, but it is recognized that it will likely take decades or longer for the Kyoto Protocol, even if implemented globally, to result in measurable reductions in the Earth's temperature. The following paragraphs provide a brief description of time lags that can be expected between the time of interventions and the desired environmental response.

Depending on the magnitude of the desired change in environmental services and the degree of degradation of the ecosystem, the attainment of desired ecosystem services may require decades or longer. In terms of realistic expectations, one of the most critical distinctions is that interventions to protect existing environmental services can be achieved/effective almost immediately. For example, paying land users to stop cutting down trees in a fully ecologically functioning forest can potentially stop ecosystem degradation immediately and maintain existing environmental services.

This is not the situation with degraded ecosystems that must be restored to provide the desired environmental services. For degraded ecosystems, restoration practices must restore a portion of impaired ecosystem structure and function and desired environmental services may require years to decades. Potential service buyers must be fully aware of these time lags. Time lags vary widely, but the table below suggests ranges that might be expected. The shorter response times would be expected for simple systems of limited size with: (1) clearly identified sources of ecosystem disruption; (2) slightly to moderately degraded ecosystem function, (3) straightforward restoration activities; (4) rapid energy and mass flow paths; (5) native flora and fauna with rapid reproductive rates; (6) restoration possible without ecological succession; and (7) little impact by non-native species.

The longer system responses would be more characteristic of complex systems of covering large areas with: (1) poorly identified sources of ecosystem disruption; (2) moderate to severely degraded ecosystem function, (3) uncertainty concerning necessary restoration activities; (4) slow energy and mass flow paths; (5) native flora and fauna with slow reproductive rates; (6) restoration impossible without ecological succession; and (7) severe impact by non-native species.

Time frames for ecosystem response at watershed scale



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PAYMENTS FOR CARBON SEQUESTRATION SERVICES

USAID PES Brief 2.1

Authors
Rohit Jindal and John Kerr[2]

Introduction

Carbon sequestration – the process of removing excess carbon dioxide (CO_2) from the atmosphere and storing it on land – helps mitigate global warming.Various land-use changes (no-till agriculture, grasslands) can absorb or sequester carbon. For instance, when barren lands are converted to forest, growing trees sequester CO_2 from the atmosphere and store it as woody biomass and soil organic matter. Conversely, when mature forests are replaced by croplands, a large amount of CO_2 is released into the atmosphere. While afforestation always sequesters carbon, one of the first large-scale projects established specifically to provide carbon sequestration services was set up in Malaysia in 1992. Supported by the FACE Foundation, the project aims to sequester 15.6 million tons of CO_2 over the next 100 years by regenerating 25,000 hectares of rain forest.

Recent technical innovations allow for accurate measurement of the amount of CO_2 sequestered by a given stand of trees or unit of land. This facilitates an arrangement whereby, instead of directly reducing their own carbon emissions, a corporation, a government, or even an individual can invest in projects that sequester carbon on their behalf. They usually buy what are called carbon offsets or carbon credits, each offset being equal to a ton of CO_2 (tCO_2) removed from the atmosphere. Farmers and landowners (producers) can thus receive payments for land-use practices that generate carbon offsets for these international investors (buyers). Because the effect on the atmosphere is the same regardless of where carbon sequestration takes place, buyers can purchase carbon offsets from anywhere in the world. Demand for carbon sequestration services has rapidly evolved into a global market consisting of two broad segments: legislated and voluntary. Each of these segments can involve either trading in carbon sequestration offsets or a project-based transaction between the end buyer and the producer (Bayon *et al*., 2007).

The table on the next page shows the four resulting market segments, which are then discussed in more detail.

[2] Department of Community, Agriculture, Recreation, and Resource Studies, Michigan State University

Table 2: Four kinds of transactions for carbon sequestration services		
	Trading in carbon sequestration offsets	Project-based transactions
Legislated	New South Wales GHG Abatement Scheme[3]	Clean Development Mechanism
Voluntary	Chicago Climate Exchange	Voluntary sequestration projects

Trading in carbon sequestration services operates under cap-and-trade regimes that require participants to reduce their carbon emissions by a certain percentage. Agencies can either directly reduce their own emissions or purchase offsets from others, including carbon sequestration offsets. These regimes operate like equity markets in which carbon sequestration offsets are equated with other kinds of offsets, e.g., from reduced use of fossil fuel, capture of methane from landfills, and shift to renewable energy. Thus buyers do not invest in any specific project, they simply purchase carbon offsets from sellers who either generated these sequestration offsets or bought them from someone else. However, not all carbon markets allow for trade in sequestration credits.

Project-based transactions occur when buyers directly invest in emissions reduction or sequestration projects and get carbon offsets in return, e.g., a company pays a local community to grow forests and claims the carbon offsets.

Legislated transactions pertain to laws that require participating entities to reduce their carbon emissions within a stipulated period. Such laws have been formulated at the local, national, and international levels. For instance, the New South Wales Greenhouse Gas (GHG) Abatement Scheme operates under local legislation mandating all local power plants to reduce their carbon emissions by 5% between 2003 and 2012. Similarly, at the international level, the Kyoto Protocol requires participating industrialized countries[4] to reduce their carbon emissions to 5.2% below 1990 levels by 2012. Under the Kyoto Protocol's Clean Development Mechanism (CDM), these countries can achieve their targets by investing in carbon emissions reduction or sequestration projects in developing countries. These projects earn carbon sequestration offsets (called Certified Emission Reductions or CERs) for the investor. However, carbon sequestration under the CDM has been limited by slow approval and stiff eligibility rules that only allow *afforestation* (growing forest on land without forest cover for at least 50 years preceding 1990) and *reforestation* (regrowing forest on degraded forest land). Further, each project has to prove *additionality* (carbon sequestration under the project being additional to what would have happened without the project), *permanence* (once planted, trees will not be cut for a certain duration), and absence of *leakage* (project participants will not cut any trees even outside the project boundary), apart from contributing to local sustainable development. The CDM Executive Board has approved only one project[5] to date with a few others in the pipeline[6].

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[3] The European Union Emission Trading Scheme, which is the major market under the Kyoto Protocol, is not cited as an example here because it allows trading in carbon emissions reductions credits, not trading in carbon sequestration credits.

[4] The United States and Australia are two important non-signatories to the Kyoto Protocol.

[5] It is based in Gaoligongshan Nature Reserve in China, where 1,200 acres of degraded land will be reforested with native trees to sequester about 160,000 tCO_2.

[6] To accelerate the approval process, the CDM Executive Board has now issued simplified guidelines for small-scale carbon sequestration projects that benefit local communities. It is also exploring the possibility of including avoided deforestation in the post-2012 phase under negotiation.

It is useful to note that one aspect of permanence is unique to carbon sequestration; once a tree is cut, it may lose all the carbon it has sequestered over the years, thus overturning all the previous environmental benefits. Therefore, CDM projects are now categorized as *temporary* (providing short-term sequestration) and *long-term* (more than 20 years).

Voluntary transactions involve corporations, governments, and individuals purchasing carbon sequestration offsets voluntarily, either for philanthropic reasons or to experiment with new carbon markets before entering the more formal ones that operate under legislated regimes. The U.S.-based Chicago Climate Exchange (CCX) is the world's biggest voluntary market, requiring its members to reduce their carbon emissions by 1% every year. In 2006 alone, CCX traded 10 million CO_2 credits worth more than $30 million, including carbon sequestration offsets from farmers in several states who practice no-till agriculture (www.chicagoclimatex.com). Similarly, companies also invest directly in voluntary carbon sequestration projects. For example, the Scolel Te Project in Mexico generates carbon offsets from forestry and agroforestry activities with farmers and has sold these offsets to the World Economic Forum, the rock group Pink Floyd, and a carbon trading company called Future Forests. Ecosystem Marketplace estimates that about $84 million worth of voluntary carbon offsets have been traded to date (www.ecosystemmarketplace.com).

Developing standards to raise the credibility of carbon credits

A major problem with the voluntary market is the poor credibility of carbon offsets due to absence of a central verification system or a registration body. Some organizations have tried to address this problem by formulating a uniform set of standards for carbon sequestration projects. Prominent among these are the Climate, Community and Biodiversity Standards (CCBS), developed by an international alliance consisting of BP, Conservation International, the Hamburg Institute of International Economics, Intel, The Nature Conservancy, the Centre for International Forestry Research (CIFOR), and the World Agroforestry Centre (ICRAF) (www.climatestandards.org). CCBS requires sequestration projects to achieve climate benefits, biodiversity conservation, and socioeconomic development. Projects that meet these standards can usually charge a price premium because they are perceived to provide higher-quality offsets.

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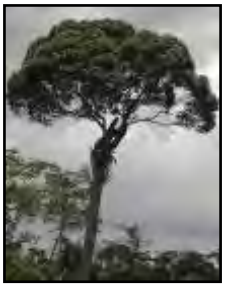

PAYMENTS FOR WATERSHED SERVICES

USAID PES Brief 2.2

Authors
John Kerr and Rohit Jindal[7]

Approach to watershed management

A watershed is an area that drains to a common point, making it a useful unit for managing water resources. The key characteristic of watersheds, from a human perspective, is that water generally flows downhill, so that upstream land uses affect downstream conditions through hydrological linkages. All over the world, watershed management efforts aim to influence this upstream-downstream relationship. They do so by encouraging upstream land-use practices that are consistent with maintaining the watershed so that it yields water that is unpolluted, low in sediment, buffered against flash floods, and with minimal fluctuations in dry-season and groundwater flows (Swallow et al., 2004). Local conditions determine what is possible and how best to achieve it. The basic scientific challenge in managing watersheds is to understand how upstream land-use practices affect natural resource conditions downstream, while the basic socioeconomic problem is to encourage people in an upper watershed to adopt those practices even though the benefits will accrue downstream – in other words, how to encourage them to deliver this environmental service.

Watersheds are the focus of a growing number of PES and PES-like arrangements. Four examples help demonstrate what is happening with payment for watershed services and provide some early lessons on the opportunities and pitfalls for further expanding this approach to watershed management.

New York City. In the 1990s, the U.S. Environmental Protection Agency informed the city of New York that it would have to build a filtration plant to ensure clean drinking water supplies. Instead of spending $4 billion to $6 billion on the plant, the city negotiated with landowners in the Catskill-Delaware watershed, the source of much of the city's water, to help them invest in whole-farm plans to reduce pollution. The plan succeeded because it emerged from shared visioning by all parties and because it was possible to develop land-use management approaches that improved farmers' bottom line while also protecting against water pollution. The resulting arrangement helped save more than $1 billion annually for the city by preserving its filtration avoidance permit

Heredia, Costa Rica. Heredia is a city whose municipal water authority serves almost 200,000 people with water that originates in micro-watersheds in the hills above the city. In recent years, the city's water quality has been threatened by changes in the watershed, including deforestation, urban growth, and livestock. In 2000, the water authority initiated a program to pay landowners to conserve and reforest lands in the upper watershed, both to limit further degradation (by eliminating cattle ranching and dairy operations close to the stream) and to rehabilitate degraded areas (through reforestation). To pay for the program, each customer of the water authority is charged a small fee, called the hydrological tariff,

[7] Department of Community, Agriculture, Recreation, and Resource Studies, Michigan State University

attached to the monthly water bill. Payments to landowners amount to $100 per hectare annually for conservation under a 10-year contract and $1,000 per hectare annually over five years for reforestation. To date there are 23 PES contracts covering about 1,200 hectares. Water consumers pay about $0.05 per cubic meter for the environmental service.

Sumberjaya, Indonesia. In Sumberjaya, the objective of watershed management is to protect against siltation and deliver a consistent flow of water to a run-of-the-river hydroelectric plant at the mouth of the watershed. Most of the 80,000 hectare watershed consists of Protection Forest, a category of government land that is to be protected to preserve watershed functions in support of downstream interests. Most of this area has been deforested and is inhabited by recent migrants who grow coffee on the land as squatters. When the hydroelectric plant was first planned in the early 1990s, the government evicted many farmers based on the belief that their land use would be bad for the power plant. Ultimately the eviction program was ineffective, and in 2000 the government established a new community forestry program in which farmers could remain on the land as long as they grew coffee in a way that was viewed as maintaining the watershed's hydrological function while protecting the remaining natural forest. In this arrangement, secure tenure is the reward for providing the environmental service. Land users form groups that apply jointly for the community forestry permit, which is good initially for a five-year probationary period, followed by a 25-year extendable permit. In Sumberjaya, 10 groups covering several hundred hectares currently benefit from the program, with another 10 groups in the process of obtaining permits. Performance is judged for the group as a whole, which is responsible for policing its members. ICRAF is conducting research in the region to determine whether these new land use practices have improved the hydrological services for the downstream users.

Sukhomajri, India. In the village of Sukhomajri in northern India, a program was devised to build small catchment ponds to provide irrigation water to the agricultural lands below. To keep the ponds functional they needed to be protected against siltation that resulted from erosion in the denuded watershed above them. Rehabilitating the watershed required revegetation, which in turn depended on eliminating grazing by goats. However, landless people living in the village stood to lose from this arrangement because they had no land to irrigate, and grazing their livestock in the upper watershed was the source of their livelihoods. When the first pond was built, they refused to abandon the upper watershed, and silt quickly filled the pond and eliminated its irrigation capacity. Villagers devised an ingenious mechanism to ensure that all inhabitants gained from protecting the watershed. All farmers were required to pay a fee for using the irrigation water, with the proceeds shared among all households regardless of whether they farmed. This way even landless people earned income from irrigation, and they agreed to protect the watershed. The village economy was transformed, as stall-fed crossbred dairy cattle replaced grazing goats and local cows, high-value irrigated crops fetched high prices and raised the demand for labor, and the upper watershed became a lush forest.

These four cases show that watershed service agreements can operate in diverse settings and take several forms. Reward mechanisms include cash payments, technical and financial assistance, secure tenure, and a share of the benefits generated by watershed protection. Despite the apparent success of the four cases, however, watershed service agreements remain scarce. The New York case is unique among large cities worldwide; the Heredia case is mirrored by a few similar cases in Latin America; the Indonesia case is quite new, so it is too soon to know how well it will work; and the Sukhomajri model was replicated successfully in only a few small watersheds in India despite a nationwide watershed development program that spent billions of dollars for watershed development on hundreds of thousands of hectares.

Characteristics of watershed service payment mechanisms, lessons learned

Localized markets. Unlike carbon sequestration, which benefits people worldwide, watershed services are localized. Changes in upstream land use only affect people living downstream in the same watershed.

Threshold effects. Watershed services have threshold effects such that a minimum percentage of the watershed must be protected to deliver the service. In the New York watershed arrangement, for example, the city insisted that, although the arrangement was voluntary, it would be valid only if at least 85% of landowners in the watershed area joined. In Sumberjaya, groups of farmers must apply for the HKm permit to make sure that a larger area is covered. For carbon sequestration, on the other hand, the service is incremental, and it is the same whether it is provided from a single concentrated area or from small, isolated places around the world.

Science must be right. There are numerous incorrect assumptions about the science of watershed hydrology. For example, it is often assumed that trees in the watershed will increase water yield, but many trees are large water consumers, thus their presence would decrease water availability in the lower watershed, not increase it. It seems reasonable that an environmental service agreement will likely fail if it is based on a faulty understanding of the relationship between a given upstream land use and its effects on downstream natural resource conditions. Moreover, not all parts of a catchment may contribute equally to watershed benefits downstream. Science can help in locating the critical source areas that can be targeted for the most cost effective management.

Benefits must be high and attributable to watershed protection. Potential watershed services vary across locations depending on agro-climatic and other biophysical conditions, including the topography, soil types, climate, and the nature of the desired service. If benefits are high, developing a mechanism to reward those who provide the service is easier than if the benefits are low. Benefits also must be easily traceable to watershed protection, or potential watershed service buyers will be hesitant to pay for them. In Sukhomajri, for example, the benefits were very high and easily traced to watershed management, generating support for the arrangement and making it feasible to share benefits among all watershed inhabitants. Efforts to replicate watershed development across India faced challenges because in most locations benefits were much lower or could not easily be traced to watershed interventions.

Costs must be manageable. It is not only the benefit side that determines whether a watershed service agreement is feasible. If costs are too high they may exceed benefits. Costs include the payment to upstream land managers (which must be high enough to exceed their opportunity cost of giving up existing land use practices), and the various transaction costs associated with organizing and executing the agreement. Transaction costs arise among potential watershed service buyers, among watershed service providers, and between buyers and sellers. As with many environmental services, transaction costs are highest when there are multiple, small scale service providers and users. It is not surprising that the cases of New York City, Heredia and many others are characterized by a single large buyer. Similarly, although it would be most unusual in a developing country context to find just a single buyer, many of the successful cases are characterized by low population density in the service providing area, with a small number of service providers. In Heredia, for example, only 21 contracts are needed to cover 1,191 hectares.

Once an agreement is made, it may be that individual payments are made to each land manager, or else that a single payment is made and the sellers must divide it up. Where payments are made in cash, there may be concerns about whether everyone gets their fair share. Payments in kind or in the form of secure property rights as in Sumberjaya may be indivisible and thus not face this problem.

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October 2007

PAYMENTS FOR BIODIVERSITY CONSERVATION

USAID PES Brief 2.3

Authors

Rohit Jindal and John Kerr[8]

Defining biodiversity

Biodiversity is often associated with the variety of life forms in an area (species diversity). However, most ecologists consider biodiversity to consist of not only species diversity but also "*the ecological roles that different species play and the genetic diversity they contain*." The Convention on Biological Diversity (CBD) goes further and defines biodiversity as "*…the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems."*

Limitations of conventional approaches to conservation

Historically, governments have arranged for biodiversity protection through direct ownership of natural resources (national parks and other protected areas), regulation of private resource use (banning use of or restricting trade in endangered species), and provision of economic incentives (taxes and subsidies). Similarly, some large international donors have spearheaded conservation efforts through land acquisitions and by implementing various conservation projects.

These approaches, however, have had insufficient success. First, there is now a wide-ranging social and political opposition to land acquisition schemes in many developing countries. Also, resource managers now realize that protecting a small number of fragmented areas will not work in the long run. Instead, they need to promote conservation of entire landscapes and ecosystems. This requires voluntary adoption of appropriate land uses that are compatible with local biodiversity. Too many interventions have given only indirect incentives to local communities to adopt these land use practices. Therefore, PES offers a new paradigm to resource managers and organizations that aim to preserve Earth's biodiversity.

Payments for biodiversity services

PES schemes provide direct and conditional incentives to land users to adopt biodiversity-friendly practices. For instance, under the Regional Integrated Silvopastoral Ecosystem Management Project, supported by the Global Environment Facility, local farmers across three sites in Colombia, Costa Rica,

[8] Department of Community, Agriculture, Recreation, and Resource Studies, Michigan State University

and Nicaragua receive regular payments for adopting silvopasture practices that generate biodiversity services. In recent years, such schemes have been taken up in several other countries. Payments for these schemes come from private corporations, international NGOs, research institutes, governments, even private individuals.

The push for such payment schemes comes not only from increased recognition of the role played by biodiversity in ecosystem functioning but also from heightened awareness of the fragility of most ecosystems. However, not all payment schemes secure the same service. Some payments are made to gain private access to particular species or habitats, while others are for buying or leasing development rights under either land lease schemes or tradable development rights systems. The largest of these are the government agro-environmental schemes, operational across Europe and North America. Under these programs, farmers receive regular payments for conservation easements, which provide a variety of environmental services including carbon sequestration, support for biodiversity and watershed protection. For example, Great Britain's Environmentally Sensitive Area (ESA) scheme conserves more than 570,000 hectares by providing payments to landowners for taking up environmentally beneficial land-use practices. The U.S. Department of Agriculture's Conservation Reserve Program pays farmers to take erosion prone land out of farm production.

Another prominent payment approach involves management contracts for habitat or species conservation on private farms, forests, or grazing lands. For example, in Costa Rica, landowners receive payments for providing biodiversity services in the form of forest conservation and reforestation. The National Biodiversity Institute (INBio) acts as a central clearinghouse for selling these biodiversity services to a host of national and international pharmaceutical companies. The companies, in turn, get bio-prospecting and gene-prospecting rights to develop new medicines. The table on the next page lists several other kinds of market-based schemes for conserving biodiversity.

Some researchers continue to identify land acquisitions with PES schemes. As is discussed elsewhere in this Source Book, land acquisitions differ from PES in that they involve transferring the property rights from the original land manager to a new one. There is no need for conditional payments because the original manager is out of the picture. Key concerns about land acquisitions are: 1) if they are enforced, they may be anti-poor, for they remove people from their lands; 2) foreign acquisition could be very unpopular politically; and 3) if acquisitions are not enforceable, then they have no conservation value. As an example, in the 1980s an advertisement soliciting donations for a U.S.-based scheme to acquire land for conservation in Latin America showed a picture of a peasant in a forest with a machete and the caption: "If you own it, they can't burn it." Without major expenditure to make the new ownership enforceable, however, the slogan would be incorrect.

Further reading

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Market-based approaches for biodiversity conservation	
Type	Mechanism
PES-type approaches	
Payments for access to species or habitat	
Bio-prospecting rights	Rights to collect, test, and use genetic material from a designated area
Research permits	Right to collect specimens, take measurements in area
Hunting, fishing, or gathering permits for wild species	Right to hunt, fish, and gather
Ecotourism use	Rights to enter area, observe wildlife, camp, or hike
Payment for biodiversity-conserving management	
Conservation easements	Owner paid to use and manage defined piece of land only for conservation purposes; restrictions are usually in perpetuity and transferable on sale of land
Conservation land lease	Owner paid to use and manage defined piece of land for conservation purposes for defined period of time
Conservation concession	Public forest agency is paid to maintain a defined area under conservation uses only; comparable to a forest logging concession
Community concession in public protected areas	Individuals or communities are allocated use rights to a defined area of forest or grassland in return for commitment to protect the area from practices that harm biodiversity
Management contracts for conservation on private lands	Contract that details biodiversity management activities and payments linked to the achievement of specified objectives
Non PES-market based approaches	
Purchase of high-value habitat	
Private land acquisition	Purchase by private buyers or non-governmental organizations explicitly for biodiversity conservation
Public land acquisition	Purchase by government agency explicitly for biodiversity conservation
Tradable rights under cap-and-trade regulations	
Tradable wetland mitigation credits	Credits from wetland conservation or restoration that can be used to offset obligations of developers to maintain a minimum area of natural wetlands in a defined region
Tradable development rights	Rights allocated to develop only a limited total area of natural habitat within a defined region
Tradable biodiversity credits	Credits representing areas of biodiversity protection or enhancement that can be purchased by developers to ensure they meet a minimum standard of biodiversity protection
Support of biodiversity-conserving businesses	
Biodiversity-friendly businesses	Businesses share in enterprises that manage for biodiversity conservation
Biodiversity-friendly products	Eco-labeling

Source: Scherr, S., A. White, and A. Khare. 2003. *Current Status and Future Potential of Markets for Ecosystem Services in Tropical Forests: An Overview*. Forest Trends. Washington, D.C.

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October 2007

PAYMENTS FOR SCENIC BEAUTY

USAID PES Brief 2.4

Authors

Rohit Jindal and John Kerr[9]

Introduction

The National Trust is a private charity in Britain that protects 704 miles of coastline of special scenic beauty by making conservation payments to local landowners. The trust is funded through donations and annual fees from more than 3.4 million members (www.nationaltrust.org.uk). Similarly, Swiss government and governments of several other European countries make payments to landowners for protecting pastoral landscapes that attract international tourists. As global tourism continues to grow, increasing numbers of tourists demand to see areas of rare natural beauty, translating into payments for land users who manage these lands.

Although payments for scenic beauty are older than payment schemes for most other environmental services, scenic beauty itself is hard to define. Carbon sequestration, watershed protection, and biodiversity conservation have some objective criteria that can be used to measure the level of the service. For instance, biodiversity can be measured by the number of endemic species in an area, while carbon sequestration is measured in terms of tons of carbon dioxide absorbed per annum. Scenic beauty, on the other hand, is more subjective, with different people valuing different attributes. It often encompasses a range of environmental services for consumptive (hunting, fishing) or non-consumptive (bird watching, boating) use.

Alternative approaches to protect scenic beauty

A common model for the provision of scenic beauty is through creation of a national system of parks or other protected areas by the government. The funding comes from budgetary allocations or by charging access fees (entrance fees, hunting licenses). Land stewards responsible for managing these lands get a share in the access fees or wider development support in terms of improvement in local infrastructure.

Governments have other measures at their disposal where they do not possess or cannot appropriate the land to create a national park. In many European countries, zoning is a key provision that protects scarce but pristine countryside and picturesque villages and cities. Many American cities also have historic preservation statutes that limit the changes that residents and businesses can make to the appearance of a given locale. In addition, some states ban roadside billboards and provide advertisement of local businesses with smaller signs with less obstruction of the natural scenery.

[9] Department of Community, Agriculture, Recreation, and Resource Studies, Michigan State University

In some cases the market itself provides sufficient incentive for landowners to protect scenic beauty. This is because real estate appreciates by virtue of being adjacent to a scenic area or a beautiful water body. Several hedonic pricing studies have shown that proximity to natural amenities tends to increase the market value of a land. Thus, real estate markets provide a direct incentive to landowners to invest in conservation activities on their land.

The market can promote scenic beauty because tourists travel to beautiful places. Historically, tourists' willingness to pay for recreation and aesthetic beauty has been mostly captured by the middlemen in the supply chain, such as tour operators and the hospitality industry. If these businesses own substantial portions of land in the area in question they will have a strong incentive to protect it. For example, in South Africa there are several privately held game reserves located adjacent to national parks. In industrialized countries there are often private campgrounds next to national parks. However, businesses in the tourist industry do not normally control all the land in the area. Threats to local scenic beauty, coupled with expansion of nature-based tourism, have led to arrangements whereby businesses in the tourism industry share revenue with other local landowners.

Summary

Among the approaches discussed in this brief, only the payments that landowners receive for protecting scenic beauty can be categorized as PES. The brief began with such an arrangement funded by governments and ended with similar approaches funded privately. For governments, such an approach may be attractive where they cannot appropriate land for protected areas or where they cannot muster sufficient political support for zoning restrictions. For private interests the same holds true. They would prefer to ensure protection of scenic beauty through assistance by the government (e.g., zoning regulations), but if that is not possible, they may offer payments if doing so results in increased revenues beyond the cost of the payments.

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PAYMENTS FOR BUNDLED SERVICES

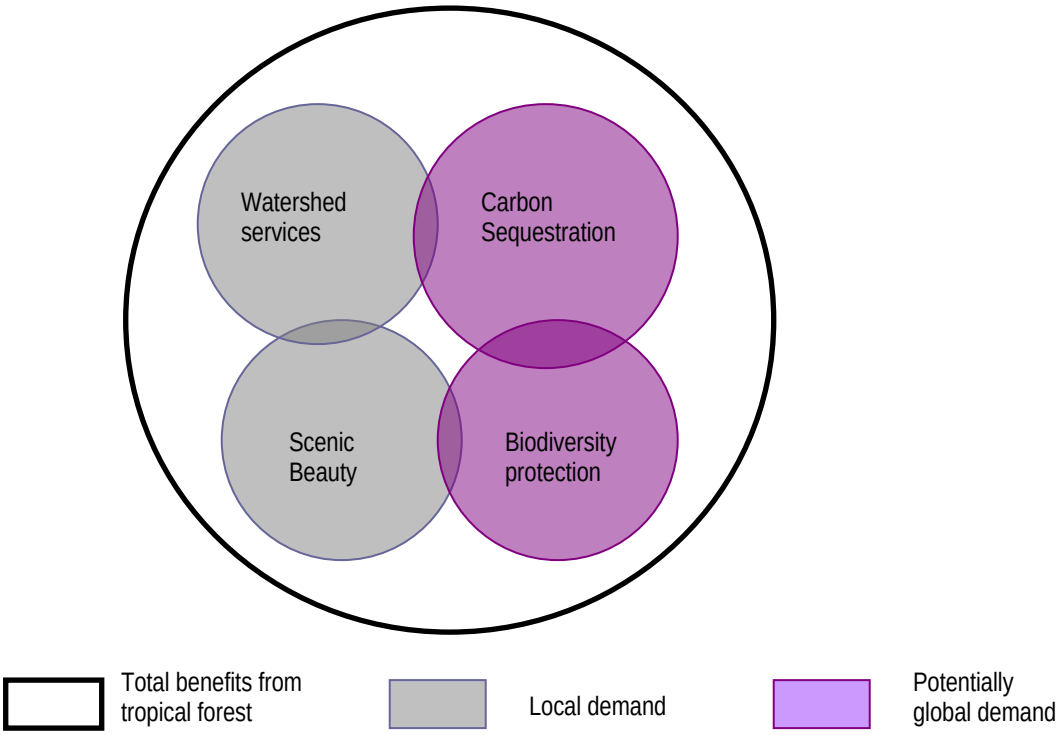
USAID PES Brief 2.5

Authors

Rohit Jindal and John Kerr[10]

Need for bundling services

Any ecosystem provides several kinds of environmental services at the same time. As we know, a tropical forest sequesters carbon, provides watershed services, is aesthetically beautiful, and conserves biodiversity (see the figure below). Selling only a few environmental services may not cover the



Environmental services from a tropical forest and sources of demand[11]

Adapted from: Pagiola, S., J. Bishop, and N. Landell-Mills (eds.). 2002. *Selling Forest Environmental Services: Market-based Mechanisms for Conservation and Development*. Earthscan, London.

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[10] Department of Community, Agriculture, Recreation, and Resource Studies, Michigan State University
[11] Demand for scenic beauty can actually extend from local to global level.

opportunity cost of conserving the entire ecosystem. Instead, conservationists may need to organize payments for as many environmental services as possible. However, this will increase the transaction costs associated with selling each service individually. The solution may lie in bundling these services and selling them as a single product. For example, in Costa Rica's PSA Program, the National Forestry Fund (FONAFIFO) buys various environmental services as a bundle from local farmers and landowners. This saves the cost of contracting for each separately while helping to conserve the entire landscape. There are two issues to consider: whether the different environmental services are complementary, and the geographical extent of the demand for a particular service.

Complementary services

Often, environmental services provided by an ecosystem are complementary. For example, when trees sequester carbon, they also regulate water flow and maintain soil fertility, as shown by overlapping circles in the figure. Local conservation practices thus will produce multiple environmental services. This means that, by paying for a particular environmental service, users can also ensure the availability of other interrelated services. The U.S. Department of Agriculture operates the Conservation Reserve Program (CRP) under which agricultural producers and landowners receive annual payments to retire from production environmentally sensitive cropland and pastures that are susceptible to soil erosion. By making these payments to plant grasses, trees, and other cover crops that can reduce soil erosion and water pollution, the CRP has been able to generate several kinds of environmental services, including reduction in non-point source pollution, protection of wetlands, wildlife conservation, and carbon sequestration.

Not all environmental services are complementary. In fact, increasing the yield of a particular environmental service can have an adverse effect on the availability of another. If only one of these services is salable, payments can distort the supply of the other. In Tanzania, on receiving carbon sequestration payments, upland farmers opted for fast-growing monocultures such as eucalyptus, which disrupted the local water regime[12]. This is a potentially common scenario. "Natural" forests usually provide a good balance of the carbon, biodiversity, and watershed services, but carbon plantations maximize one at the expense of others. Better-balanced and bundled services may also mitigate the special risks of impermanence that are unique to carbon. The Regional Integrated Ecosystem Management Project in Nicaragua, supported by the Global Environment Facility, avoids this distortion by making payments based on an Environment Services Index (ESI) that combines biodiversity conservation with carbon sequestration services. At the time of enrollment, a baseline score is calculated for each farm, and farmers receive a one-time payment of $10 per point. Thereafter, the project pays $75 annually for each incremental ESI point. Farmers thus have an incentive to maximize their overall ESI score rather than produce any single environmental service[13].

Local or global?

One major constraint in selling environmental services as a bundle is that some services have a local demand, while others have a potentially global demand. As the figure shows, soil fertility, watershed services, and erosion control have localized users. On the other hand, carbon sequestration, scenic beauty, and wildlife protection are valued by people globally. Local users are unlikely to pay for services that are not valuable to them, while global users will not pay for local services. Service providers or

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[12] While some of these mutually incompatible relationships are known, many others are still to be discovered. For example, trees can have a positive, negative, or neutral effect on hydrological services downstream depending on soil conditions, slope, rainfall intensity, species mix, and planting density.

[13] The choice of any environment index will remain subjective, for many environmental services remain unrecognized and uncompensated, as illustrated by white space within the big circle in Figure 2.1.

intermediaries may need either to create separate bundles for local and global consumers or provide a portfolio of environmental services from which buyers can select according to individual preference. Either option, though, will add to the complexity of PES projects. Project managers need to balance high revenues with high transaction costs when selling environmental services as separate entities, and lower returns but with reduced complexity when selling services as a bundle.

In the case of Costa Rica's national PES program, the intermediary organization FONAFIFO has struck this balance by purchasing various environmental services as a bundle from local landowners before unbundling them to sell to different buyers. Thus, watershed services have been sold to local hydroelectric companies, while carbon sequestration services are being marketed globally. The Costa Rica case serves only as an illustration, as each PES project must achieve its own balance between bundling and selling services separately.

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BUYERS, SELLERS, INTERMEDIARIES

USAID PES Brief 3.1

Authors

Rohit Jindal and John Kerr[14]

Introduction

Most PES transactions involve three distinct stakeholder groups: buyers, sellers, and intermediaries. Each of these groups can consist of individuals, organizations, even governments. This brief summarizes important characteristics of these groups, including their motivations to enter into a PES transaction.

Service users or buyers

Historically, people have benefited from environmental services without making any payments for them. In many cases, however, there is now a well-identified set of people who not only benefit from an environmental service but are also willing to pay for it. These people include individuals (water users in a town), groups (farmer associations), local governments, utility companies, multinational corporations, private foundations, even national governments. In Ecuador, for example, the city of Quito pays upstream farmers to protect two watersheds that supply most of the city's water. Payments are made through an independent fund, FONAG, established by the municipal water company and other local utility companies. Similarly, under its Conservation Reserve Program, the U.S. Department of Agriculture makes regular payments to local farmers for taking environmentally sensitive land out of crop production and planting it with grasses, trees, and other cover crops. This helps reduce soil erosion and water pollution and generates several other valuable environmental services. Why are these organizations paying for environmental services?

One factor contributing to willingness to pay for environmental services is their perceived shortage. As ecosystems deteriorate, many valuable services are threatened. Various approaches are used to protect them – regulations on the use of natural resources, for example. But these approaches have had limited success. The newest idea is to directly pay people to protect valuable ecosystems. The Nature Conservancy, for example, pays local land users to protect valuable biodiversity in tropical forests. Also, several new regulations and institutional innovations at the international level (the Kyoto Protocol to curb carbon dioxide emissions) and nationally (the U.S. Clean Air Act) require companies to comply with strict environmental standards. A cap and trade mechanism enables participating companies to keep their compliance costs low by allowing them to pay another company to provide an environmental service on their behalf. In carbon markets, such a company also can claim credits by planting trees to sequester carbon, or by paying landowners elsewhere to sequester carbon on its behalf. Government regulations also stimulated the well-known case in which New York City invested in upstream communities to protect streams feeding its water supply. The alternative was to comply with an order by the U.S.

[14] Department of Community, Agriculture, Recreation, and Resource Studies, Michigan State University

Environmental Protection Agency to build a new water filtration plant. The PES arrangement saved the city billions of dollars.

Demand for environmental services is also generated by companies that wish to maintain goodwill among consumers. BP, the British oil giant, pays for carbon sequestration and other conservation projects to maintain its green image. Investing in carbon sequestration is also a way for managing risk and liability for many multinational corporations, especially since science has recently established links between major climatic disasters and global warming.

In fact, the role of science is crucial in defining what exactly the service users are buying. Protecting an upstream catchment could generate hydrological benefits in the form of reduced sediment flow and improvement in the groundwater table. A hydroelectric power company may be interested only in the former, while a municipal water utility may be willing to pay for the latter. Thus, depending on the value that an environmental service holds for a particular buyer, science can help in identifying appropriate land uses[15]. A related point is that scientific advances increase the capability to trace environmental services, making the buyer of an environmental service more confident of getting what it pays for. Improvements in measuring and estimating carbon emissions and carbon sequestration have enhanced PES arrangements in these areas, and continued scientific advances could stimulate demand for other types of environmental services in the future.

The nature of an environmental service also determines the geographic extent of its demand. Watershed services will be bought primarily by downstream communities in the same basin, while carbon sequestration services can be bought by someone living far away from where they are produced. Demand for biodiversity and scenic beauty can extend potentially from the local level to global.

Service providers or sellers

Land users in a position to influence the quality or quantity of an environmental service through their conservation practices are potential service providers or sellers. Service providers can consist of individual farmers, community groups, government agencies, and even private companies that can ensure the availability of an environmental service in return for payments. In the example of Quito, upstream farmers in the two watersheds are the service providers. Similarly, private companies that raise plantations to generate carbon sequestration offsets are service providers for carbon investors. Some key issues related to service providers are:

- The new institutional and technical innovations that stimulate service users to purchase environmental services also create the incentive for land users to supply them.

- The nature of an environmental service determines its potential sellers. When a biodiversity hot spot is to be protected, all land users in the vicinity need to be involved in a PES program. On the other hand, a given quantity of carbon sequestration could be supplied jointly by a number of land users far away from each other.

- Local topography influences the cause-effect relationship between specific land-use practices and the environmental services they generate. People who are willing and able to adopt these practices on a voluntary basis can assume the role of service providers.

[15] However, not all environmental relationships are known with certainty. Therefore, creation of demand for environmental services is also contingent on the development of new scientific knowledge.

- Often, environmental services are produced by a group of land users adopting common practices. In such cases, apart from payments from service users, collective action will be required at the community level. For instance, in Sukhomajri, India, the entire village community eliminated open grazing in the upper watershed to protect the irrigation ponds downstream. Adoption of new land-use practices by only a few users on only a part of the catchment would not have helped save the irrigation ponds from silting.

- Property rights and norms in an area determine who can participate and who cannot. A PES program that pays local people to sequester carbon over a long time usually leaves out people who do not have land titles, because they may not be able to make long-term promises about land use. A community based project such as Nhambita Community Carbon Project in Mozambique includes all members of a particular community but leaves out others who are not members.

Intermediaries

Intermediaries are individuals, groups, NGOs, local governments, donors, or private companies that help service users and potential suppliers set up successful PES transactions. Intermediaries perform various roles, the common purpose being to reduce transaction costs. These roles range from linking the service users and suppliers to taking over the implementation of the PES program itself. In early stages of a PES program, buyers need credible information on potential suppliers, their location, and the kind of environmental services they can provide. Similarly, service providers are looking for potential buyers who are willing to pay for an environmental service. Intermediaries help to bring the parties together, conducting negotiations and finalizing mutually beneficial agreements. When an environmental service is provided by more than one supplier, intermediaries can help organize these multiple providers into groups. For example, the Iowa Farm Bureau aggregates carbon sequestration offsets from different farmers in the United States before selling them to the Chicago Climate Exchange (CCX). If these farmers were to sell carbon offsets on their own, the transaction costs associated with registering with the exchange and completing necessary formalities would consume most or all of their earnings. Instead, the Farm Bureau cuts down transaction costs by achieving economies of scale. Similarly, when multiple service users are involved, intermediaries can negotiate contracts with service providers on their behalf. This often happens for hydrological services when a municipal water company sets up watershed protection contracts on behalf of all the residents of a city.

Intermediaries can also buy environmental services from local land users before supplying them to end consumers. Costa Rica’s FONAFIFO buys different environmental services as a bundle from local landowners before unbundling them and supplying them separately to a mix of national and international buyers. Similarly, the local subsidiaries of TIST in India, Uganda, and Tanzania buy carbon offsets from individual farmers and then supply these credits to international investors. As a result, local land users do not incur costs of looking for international buyers and of setting up contracts with them.

Intermediaries provide useful ancillary services such as third-party monitoring and verification of PES contracts. For instance, FORECON provides third-party verification of carbon stocks for land users in Michigan before they can sell carbon offsets on the CCX. This verification provides an assurance to CCX members that they are purchasing standardized carbon offsets, which can easily be traded with other kinds of emission offsets available on the exchange. International donors and multilateral organizations such as the Global Environment Facility also help to kick-start new PES programs by covering their setup costs. USAID and the Nature Conservancy helped to establish FONAG in Ecuador by providing it with seed money and covering some of the administrative costs. Similarly, the World Bank has formed four carbon funds that promote different kinds of emission reduction projects globally.

Finally, intermediaries play an important role in forming new policy. Agencies like ICRAF and CIFOR use their global mandate and experience from implementing various PES programs to frame laws that are effective in protecting the environment, apart from being pro-poor.

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October 2007

VALUING ENVIRONMENTAL SERVICES

USAID PES Brief 3.2

Authors

Rohit Jindal and John Kerr[16]

Why valuation?

Payments for environmental services usually signal the value that service users attach to them or the opportunity cost for land users to provide the same. The absence of markets for most environmental services makes it difficult to estimate a payment structure acceptable to both parties. For instance, an ecosystem may provide several kinds of environmental services, with only a few being valuable to service users. Similarly, opportunity costs for service providers will depend on the specific land uses they are asked to adopt. Therefore, an *ad hoc* payment structure will rarely work in the long run. Instead, PES programs must conduct careful analysis to estimate values of the environmental services they are going to secure. In some cases, like carbon sequestration, it is becoming to use actual market values as those markets come into being. Where there are no markets, methods to estimate value include: 1) imputing the value of the environmental service from observable phenomena; 2) using the survey-based approach known as contingent valuation to estimate buyers' willingness to pay (WTP) for a service and sellers' willingness to accept (WTA) compensation in return for providing a service, and 3) using auctions to identify actual WTP and WTA. Several techniques can be used to conduct these experiments, which are part of a growing field in economics called non-market valuation.

Examples and issues for further consideration

Imputing values. Imputing the value of an environmental service can be done in a variety of ways, depending on the situation. For example, a study in Manggarai, Indonesia, carried out an implicit economic valuation of a change in water flow levels from an increase in forest cover in the upstream areas. Using hydrological modeling, the study projected that an increase in forest area will increase the baseflow in only four out of nine counties in the region. Economic benefits for local residents in these four counties were estimated in the form of annual savings in water collection costs. Multiplying the number of labor hours saved by the prevailing wage rate gives a ballpark estimate of the value of the environmental service. The savings ranged from 1,773 Indonesian rupiah (about $2) per household in one county to 2,669 rupiah per household in another. However, an increase in upstream forest cover could reduce baseflow in the other five counties, with annual losses (in the form of increase in water collection cost) per household ranging from 2 rupiah in one county to 5,052 rupiah in another. Interestingly, although the change in land use is the same across all counties, it reduces water collection costs in only four of the nine counties. Residents in these four counties may thus be willing to pay a small amount for a forest protection program while the residents across the other five counties would prefer to avoid this land use change.

[16] Department of Community, Agriculture, Recreation, and Resource Studies, Michigan State University

The travel cost method is another approach for imputing value, particularly for scenic beauty that attracts tourists to visit a particular site. The amount that tourists spend to travel to the site indicates the minimum economic value that these users place on the site. A recent study in Michigan used this approach to suggest that the total annual recreational value of the Saginaw Bay coastal marsh area in Michigan was $15.9 million; or a lifetime recreational value of $239 million for all residents in Michigan.

Estimating values from survey data. Often, instead of carrying out an implicit valuation of an environmental service, researchers may directly question service users about their WTP for a hypothetical improvement in an environmental service. Such questionnaire-based studies constitute contingent valuation (CV) surveys whereby researchers estimate a demand curve for a particular environmental service. For instance, the study of Saginaw Bay used the Contingent Value Method to suggest that state residents are willing to pay a total of $207,000 per annum to protect an additional 1,125 acres of this coastal area.

Researchers may ask service providers about their WTA for providing a certain environmental service. Ideally, payments should lie above providers' WTA and below buyers' WTP. This method has been used in improving the water quality in Heredia, Costa Rica. The public utility of Heredia (ESPH) charges local residents an additional $0.05/m^3 in their monthly water bills for protection of upstream watersheds. The payment is less than the replacement cost for downstream water users and more than the estimated opportunity cost for upstream land users.

A study under the RUPES project in Indonesia used conjoint analysis to identify specific preferences of services providers. Under this method, service providers are asked to choose among contracts that vary by their attributes. Survey respondents can choose among a set of hypothetical contract characteristics, for example, the duration of the contract, the type of the reward, the types of restrictions, etc. Using a regression equation, researchers can construct standard contracts from the attributes most preferred by service providers (in addition to the service buyers, of course).

A major limitation of those methods is that they are based on stated preferences of the respondents, which may or may not be their true preferences. Thus, a WTP estimate may not necessarily translate into actual payments when the conservation program is introduced. The same is true for WTA.

Auctions. Environmental service providers and buyers may have asymmetric information, meaning that the two parties do not have the same information and thus one may take advantage of the other in negotiating a payment system. In particular, it is difficult for service users to know under what conditions land users would be willing to provide an environmental service. This may lead to poorly structured payment systems that cost more than they need to or that end up paying those who would have provided the service anyway without influencing the land use of those who do not provide the service.

Some economists suggest that an effective way to deal with the asymmetry is to conduct auctions among service providers. Auctions are based on the premise that, when service providers compete for a contract, they are bound to reveal their true preferences. Under auctions, buyers invite bids or tenders from potential suppliers of a particular environmental service, then select the lowest bids. This method is supposed to be cost-effective, providing the biggest conservation bang for the buck. Auctions are commonplace in cap-and-trade systems (such as the acid-rain program in the United States) where various companies bid on emission permits.

The best-known example among PES-type programs is the Conservation Reserve Program in the United States, where landowners make offers to receive payments in return for retiring their land from crop production. The U.S. Department of Agriculture ranks these offers by the environmental sensitivity of the land and selects bids that provide the best combinations. However, a major constraint with auctions is that

their political and social feasibility in the context of developing countries is still to be tested, and paying two neighbors differently for the same environmental service may lead to resentment. RUPES is conducting some experimental auctions in Indonesia, which may suggest the way forward.

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October 2007

PAYMENTS AND CONDITIONALITY

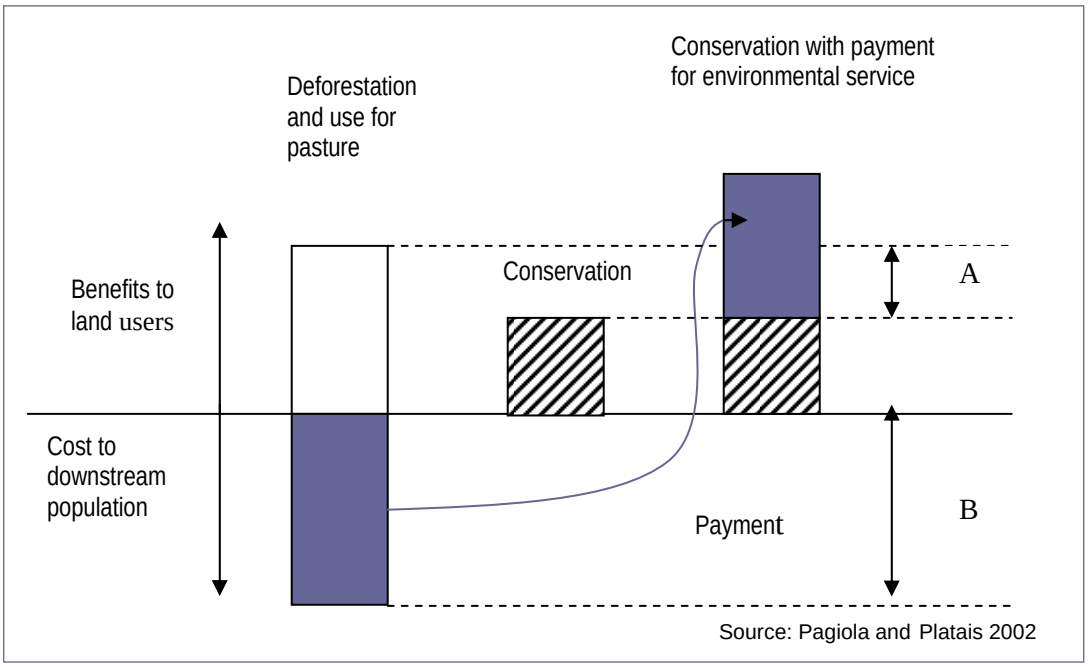
USAID PES Brief 3.3

Authors

Rohit Jindal and John Kerr[17]

Introduction

PES programs are based on the principle that land users who provide useful environmental services should receive payments from people who consume these services. These payments, also referred to as rewards or compensation, as discussed below, can be made for reducing environmental threats (foregoing land use that is detrimental to downstream communities) or for investing in new land-use practices that create positive benefits for downstream communities[18]. The logic behind all payments is the same, as shown in the figure below.



The economic logic of payments for environmental services

[17] Department of Community, Agriculture, Recreation, and Resource Studies, Michigan State University
[18] The word "downstream" is used generically here. It can range from people who literally live downstream in a watershed to people who live off-site but consume environmental services produced by others.

As illustrated, when land users cut a forest and convert the land to pasture, they receive economic benefits from selling timber and raising livestock. This deforestation generates a negative externality for downstream communities in the form of increased cost of flooding and sedimentation. Upstream land users may be reluctant to conserve the forest or plant new trees if the opportunity cost of conservation (the economic benefits from converting the forest to pasture) exceeds the direct benefit to them, say, from non-timber forest products and any other benefits associated with the forest. A payment from the downstream population to upstream land users can change this incentive structure. It will give land users a direct incentive to invest in conservation, as economic benefits to them are greater than their opportunity cost. For the payment to be viable, it should be greater than the difference between the benefits from deforestation and conservation for upstream land users (segment A), and less than or equal to the cost downstream communities face due to upstream deforestation (segment B).

Rewards or compensation?

Instead of using the term "payments," some people prefer to call them "rewards" or "compensation" for environmental services. The terms have only subtle differences, although "rewards" and, to a lesser extent, "compensation" invoke the idea that the payment need not be in cash. All the terms are equally valid, and in many respects the differences lie in the eye of the beholder: people vary in how they interpret them. In any case, the idea is to adequately cover the opportunity cost of service providers in securing an environmental service. Cash payments can be any amount more than the minimum willingness to accept (for service providers) and less than the maximum willingness to pay (for buyers). The minimum payment that service providers may be willing to accept presumably covers the opportunity cost of other foregone opportunities, any investment costs they must make in a new land use that generates the environmental service, and an appropriate risk premium if landowners fear that an environmental service contract will create new risks. If providing the environmental service requires an investment but does not involve foregone opportunities, then it is possible that service providers are recompensed only when they invest in new land-use practices, and land users who do not incur costs do not receive any payment. Compensation in this case would ensure strict additionality.

Non-cash rewards follow the same principle: They must offer economic benefits acceptable to the providers. Non-cash rewards may be in an indivisible form that provides benefits to all the people in an area, for example, by providing government services or land tenure security. This may be attractive in a group setting to avoid the transaction costs associated with paying numerous small landowners and ensuring that each receives his or her share. For simplicity, in this Source Book we use the term "payments," which, depending on context, can also be interpreted as either rewards or compensation.

Direct and conditional

PES is distinct among incentive-based conservation approaches because it provides direct inducements to service providers, conditional on continued provision of the service. Directness implies that payments or other economic benefits are directly targeted to provision of the service. For example, a payment made in exchange for providing the environmental service is perfectly direct, but a payment or reward that is embedded in some kind of broader economic development initiative is not very direct. Similarly, a benefit that accrues to the entire community may not provide direct incentives to each individual member to adhere to the land-use practices that constitute the environmental service. In other words, they may have an incentive to act as free riders, and it is up to the community to enforce compliance.

Regular monitoring is necessary to determine conditionality. However, it is easier to establish conditionality for some services (carbon sequestration) than others (scenic beauty) due to existence of

objective criteria that determine the level of the service. Program managers also need to decide whether to monitor output (tons of CO_2 sequestered, reduction in silt load), or changes in land use (afforestation on a certain proportion of the land, adoption of no till agriculture), or change in agricultural inputs (reduced use of fertilizers). Often the choice of a monitoring protocol is driven by the kind of technology that is available and the need to achieve a balance between high monitoring costs and the need to establish strict conditionality.

Conditionality in turn implies that payments are made only as long as the environmental service in question is provided. Ideally, for payments to be conditional requires that they be made over time rather than up front. In the case of one-time payments (e.g., up-front cash or building a road or granting land titles), the service buyer has no leverage over the seller to continue providing the service. Long-term conditionality requires that rewards can be revoked or that payments continue to be offered over time.

Some examples illustrate directness and conditionality:

The International Small Group and Tree Planting Program (TIST), India. This program pays local farmers for sequestering carbon through plantations on private lands. Participating farmers receive quarterly payments on the basis of each live tree on their farms. If a farmer cuts down a tree, the payments are reduced accordingly. Payments are financed by selling carbon sequestration offsets to international buyers.

Sumberjaya, Indonesia. Under the Indonesian government's social forestry or HKm program, groups of land users have received licenses that provide tenure security, conditional on protecting natural forest and growing coffee in a way that controls the flow of silt into the downstream hydroelectric power station. This is an example of a noncash reward mechanism. The license can be revoked if the group does not adhere to the environmental service agreement.

WfW, South Africa. The Working for Water (WfW) program is a public-works program that employs low-skilled and unemployed laborers to remove invasive plant species, primarily from public lands. The program is funded through government budgetary allocations. It compensates workers for their labor to secure environmental services on public land. This is more a public works program and less a PES program since the actual land managers are not the ones receiving payment for providing an environmental service.

Nhambita Community Carbon Project, Mozambique. Members of the Nhambita community have taken up agroforestry in return for carbon sequestration payments. A portion of the payments is provided directly to individual farmers depending on the area under each property that is put under agroforestry, while the balance is deposited in a community account. The community account can be used to take up development projects that benefit all local residents. Payments are funded partly through donor support and partly through sale of carbon sequestration credits to international companies.

Further reading

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TRANSACTION COSTS

USAID PES Brief 3.4

Authors

Rohit Jindal and John Kerr[19]

Introduction

Transaction costs are the costs of negotiating, contracting, implementing, and monitoring a PES program. They include all costs borne by a PES program other than those of actually producing an environmental service (such as investment in new land-use practices). These costs include not only monetary but also non-monetary costs, such as time expended by various program participants. Transaction costs can be divided into two broad categories: (1) *ex ante* or initial costs of achieving an agreement, and (2) *ex post* or costs of implementing an agreement once it is in place. The specifics under each of these categories can vary by case. In general, PES programs face costs related to searching for program partners, negotiating contracts, obtaining necessary approval, monitoring program activities, complying with contractual agreements, and insuring against the failure to secure the environmental service, as shown in the table below.

Kinds of transaction costs for PES programs	
Cost category	**Type of cost**
Search	Finding interested partners to the transaction Communication (e.g., expenses for telephone and sales representatives) Price information and quality control (e.g., agents)
Negotiation	Coming to an agreement (e.g., time, visits, and drafting of contract)
Approval	Expenses that arise when the trade must be approved by a government agency (e.g., modifications)
Monitoring	Establishing the baseline, observing the transaction and verifying adherence to the terms of the contract (e.g. ,hiring a verification service)
Enforcement	Insisting on compliance once divergence from contract is detected (e.g., suing the seller)
Insurance	Insurance policies (e.g., for compensation in the event of loss of the good)

Source: Dudek and Wiener (1996)

Transaction costs are a significant component for most PES programs. One study on carbon sequestration projects found that transaction costs ranged from 6% to 45% of the total PES cost.
Scolel Te in Mexico, a community carbon sequestration project covered by the study, spent more than $1.3 million on transaction costs, 33% of the total budget.

[19] Department of Community, Agriculture, Recreation, and Resource Studies, Michigan State University

Need for reducing transaction costs

Transaction costs increase the expense of securing an environmental service through PES. In fact, some environmental services are so difficult to monitor that payment is impossible. Even in less extreme cases, high transaction costs reduce the quantity of an environmental service traded, reducing the gains from trade and the size of the market for an environmental service.

Transaction costs have a high fixed component, which means that relative costs decline as the volume of environmental services being traded increases under any given project. Consequently, a big PES program, covering a large volume of environmental services, faces much lower costs per unit than a small program. Moreover, transaction costs tend to escalate when more parties are involved. Therefore, costs are much higher in absolute terms when dealing with multiple parties rather than a single party. Both these factors have an adverse effect on feasibility of PES programs that aim to work with smallholders. High-volume PES programs that contract with a few large landowners face much lower transaction costs than those that need to enroll a large number of service providers who own only small pieces of land. As a result, PES programs that aim to alleviate poverty by contracting smallholders can find it difficult to break even. To maintain their pro-poor focus and share a larger proportion of revenue with service providers, PES programs must find a way to reduce their transaction costs. There are three broad ways to achieve this: by simplifying guidelines for design and formulation of PES programs, reducing costs of monitoring and measurement, and adopting institutional innovations.

Simplifying guidelines

Most PES programs work under some kind of regulatory system or a set of guidelines. These can include multilateral environmental agreements, national policy frameworks, even how participating agencies design a particular program. Simplification of guidelines is a must if transaction costs are to be reduced and thus for programs to be pro-poor. For instance, initial guidelines under the Kyoto Protocol were considered too strict for small-scale carbon sequestration projects. The protocol's executive board has now simplified requirements (design, registration, validation, and monitoring) to reduce transaction costs for carbon sequestration projects that target low-income communities and generate emission reduction of less than 8,000 tCO_2 annually. Similarly, the CCX has formulated a very simple set of rules governing the sale of carbon sequestration offsets from no-till lands in the United States. The CCX issues carbon offsets to no-till farmers at a flat rate of 0.75 t CO_2 per acre annually. This is a lower bound of the average sequestration rates in the United States but helps landowners to save transaction costs associated with estimating each separate farm's sequestration rate.

Reducing costs of monitoring and measurement. Payments under PES programs are contingent on observable improvements in the quality or quantity (as contracted) of an environmental service. Therefore, programs must carry out regular monitoring to verify that proper land-use practices are indeed being followed and to measure or estimate the specific amount of environmental service being generated. Usually, PES programs prepare a baseline before the program is initiated and then monitor the impact of prescribed land uses at regular intervals. The purpose is to justify the continued provision of economic compensation by demonstrating that the program has been able to secure the environmental service. Monitoring rules are also prescribed by the policy frameworks under which specific PES programs function. For instance, the Kyoto Protocol requires carbon inventories to be assessed every five years by independent verifiers.

Monitoring and measurement costs are a significant component of transaction costs. These costs tend to escalate further when program sites are non-contiguous. Thus monitoring costs are lower for large

landowners and higher for smallholders with fragmented pieces of land. To save on monitoring costs, PES programs should involve local experts for monitoring rather than rely only on external experts. Moreover, research organizations are developing new, less expensive ways to monitor that can be more easily adopted. For example, ICRAF has developed a simple approach to measuring sediment in a river that can help determine the impacts of land use changes. For carbon sequestration, monitoring on small land holdings can be done using simple forest measurement techniques to estimate tree growth and a handheld GPS (geographical positioning system) device to identify the location. The GPS devices are relatively inexpensive, easy to use, and can help in more rigorous tracking of carbon plantations. The TIST project in India has trained village-based volunteers to take field measurements using this technique. A single carbon expert in the central office then uses the field measurements to calculate carbon credits for each site.

It is useful to remember that markets for many environmental services did not exist because it was extremely difficult (and expensive) to monitor them. Recent technological advances have helped to address this problem for only a few environmental services. Therefore, researchers and scientists will continually need to strive to develop more effective and efficient means of monitoring.

Institutional innovations

Institutional innovations pertain to both changes in organizational setup and modifications in formal and informal rules of operating a PES program. Institutional innovations make up a vast field, and the aim here is to focus on key ideas. Some are discussed below, while others are just listed in the table on the following page.

Intermediaries. Groups such as NGOs, government agencies, and international experts help reduce transaction costs by linking buyers with service providers. Many consultancy groups and research networks now host free information portals on the internet (e.g., Katoomba Group's www.ecosystemmarketplace.com) that help spread information about the location of potential suppliers of environmental services and about large corporate investors willing to pay for them. Donors can help catalyze PES programs by providing essential financial aid to cover transaction costs, at least in the initial stages. For example, the United Kingdom's Department for International Development funded the initial administrative costs for setting up the Scolel Te carbon sequestration project in Mexico. Similarly, the Global Environment Facility has supported many biodiversity protection projects all over the world in the hope that they will become self-sustaining over time.

Contracting with small farmers in groups. Working with groups rather than individuals can achieve economies of scale. Group contracts can supply environmental services from both common and private lands. The major innovation in this regard is that instead of setting up individual contracts, the program formulates a single contract with the entire group. This encourages the participation of smallholders and even landless people who have a role in managing common lands. New formal institutions under PES programs should complement the pre-existing formal or informal organizations among community members. PES programs also must ensure that the poor members gain equally from group-based sales

Institutional Innovations to Reduce Transaction Costs		
INSTITUTIONAL INNOVATION	ACTIVITIES	EXAMPLES
Create specialized services from intermediary organizations	Specialized firms or agencies for community-based projects can: - provide technical expertise in project design - support central negotiations - establish mechanisms for financial transfer - verify PES actions -Baseline measurement and performance monitoring?	The Nature Conservancy role in brokering forest carbon projects in Belize, Bolivia, and Brazil. RUPES works as an intermediary between the government and local NGOs in the HKm Forestry Project in Indonesia.
Build on existing community development programs	- Diagnose local needs, priorities, and PES opportunities - Strengthen community organization and local knowledge related to a PES project	Farmer-researcher partnership in Scolel Te, Chiapas, Mexico
'Bundle' environmental service payments	- Develop multiple payments for different activities on the same piece of land	Costa Rica PES program bundles carbon, biodiversity, and watershed protection services .
Establish large-scale, area-wide projects	-Develop project over entire jurisdiction -Partner with other small providers to share transaction costs of project development	Forestry project in Madya Pradesh, India, is working with 1.2 million households.
Create cost-sharing mechanisms	-Contributions by national or state agency, overseas development assistance, development, or environmental NGO, private companies, municipal utilities, local communities	Australian forest conservation: rice farmers to market 'green' rice at premium
Reduce data costs	-Improve data and methods for project planning, baseline development and monitoring	Low-cost participatory carbon monitoring methods, such as at Noell Kempff project in Bolivia

Source: Smith and Scherr, 2002.

of environmental services, as some kinds of rewards, particularly cash, are often prone to elite capture. Indivisible, in-kind rewards such as tenure security (where appropriate) may benefit everyone in the group.

It is important to consider that contracting with farmers as a group does not entirely eliminate the transaction costs associated with contracting with smallholders. Some of the costs that no longer occur between the buyer are seller instead are incurred within the group. For example, the buyer only need contract with and monitor compliance by the group as a whole, but the individual group members must jointly agree to enter the contract, monitor each other to ensure compliance with the buyer, and share the payment among all the contributing members. These activities can be arduous and a group-based PES arrangement is more likely to be viable for some groups than others. It is not a universal solution.

Portfolios of projects. These can also reduce transaction costs as implementing agencies share valuable physical and human resources across projects. As standardized operating procedures develop at one project site, they can be easily replicated elsewhere. For example, the Edinburgh Centre for Carbon

Management initiated its Plan Vivo system for carbon sequestration under the Scolel Te project in Mexico and then replicated it in Uganda and Mozambique. Similarly, the FACE Foundation manages carbon sequestration on about 170,000 hectares of land across six countries. Such a diverse portfolio also helps distribute risk while sharing learning from one site to another.

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SECURING ENVIRONMENTAL SERVICES AND ALLEVIATING POVERTY

USAID PES Brief 3.5

Authors

Rohit Jindal and John Kerr[20]

Introduction

PES programs can have a significant impact on the poor. This is because potential service providers often constitute poor land users who depend directly on the local resource base for their livelihoods[21]. Payments for securing useful environmental services potentially represent an opportunity to improve the economic well being of the poor who provide services. PES literature often highlights the potential compatibility between environmental conservation and poverty alleviation, so much so that some organizations now consider PES primarily as a tool for reducing poverty.

Skeptics, however, question the effectiveness of a market-based instrument like PES to benefit the poor. A crucial point often overlooked in the debate is conditionality, which makes PES unique among various incentive-based conservation approaches. PES programs are based on the principle that people who benefit from environmental services may have to offer payment to the land users who are in position to provide the services. Of course, buyers will not want to pay for services they obtain without paying, and they will not want to make payments to people who do not provide the service. Payments are thus conditional on the continued supply of and demand for the environmental service in question. For PES to benefit the poor, they must be able to provide the desired service, and demand for it must persist, or else payments may no longer be forthcoming. In fact, PES programs must take care to avoid situations where poverty alleviation and environmental protection objectives compete with each other. If efforts to help the poor in a PES program come at the expense of delivery of the service, the program may fail, in which case of course it cannot help the poor.

If a PES program is in place, as service providers supposedly enter into PES contracts on a voluntary basis, it is generally assumed that payments will make them no worse off and in most cases will provide them with additional income. However, discerning the impact of a PES program on the poor is often more complicated than this. The poor may not be able to participate

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[20] Department of Community, Agriculture, Recreation, and Resource Studies, Michigan State University

[21] This statement applies mainly to developing countries. However, even in rich countries, upstream communities are often found to be poorer than urbanized communities downstream.

in a PES program for various reasons described below. PES contracts may be rigid, trapping the poor in long-term commitments that are not beneficial for them. There are also indirect effects on people who do not participate in the program. The following sections summarize the main issues to be considered when designing pro-poor PES programs. The aim is to highlight only those issues that are unique to PES (see the table below). Also, the focus is only on the service provision side of the story – poor people may benefit as environmental service users, but that is not addressed here.

Potential impact of PES programs on poor people		
Group	Potential impact	Extent of impact depends on
Impact on sellers		
Landowners with secure tenure	Income from PES (+)	• Amount of payment (+) • Opportunity cost (–)
Landowners with insecure tenure	Income from PES (+)	• Amount of payment (+) • Opportunity cost (–) • Ability to participate (+)
Tenants	Income from PES (+)	• Amount of payment (+) • Opportunity cost (–) • Division of benefits with owner or risk of eviction (-)
Downstream service users	Payment for PES (–) Receipt of services (+)	• Amount of payment (-) • Consequences of lack of PES system (+)
Impact on non-sellers		
Farm workers	Change in labor demand (+/–)	• Relative labor needs for current and PES-promoted practices (+/–) • Other employment opportunities (+/–)
People dependent on non-timber forest product (NTFP) collection	Change in availability and access to NTFPs (+/–)	• Nature of current and PES-promoted practices (+/–) • Local context
(+) Positive impact; (–) Negative impact ; (+/–) Uncertain impact; depends on case-specific circumstances		

Source: Pagiola et al., 2005

Barriers to participation

The first question that a pro-poor PES program needs to consider is whether the poor can participate. Constraints to participation include tenure insecurity, high investment and opportunity costs, high transaction costs, and the nature of the environmental service.

Tenure security. The poor often do not have secure land title, which may bar them from obtaining PES contracts. This is especially true for services such as carbon sequestration, where payments are tied to permanence of the service. If service providers do not have secure title to the land, it may be difficult for them to convince buyers that the flow of services will be maintained in the future. Landless poor may in fact be ineligible to participate in such PES programs. Similarly, in the case of rented land, tenants cannot promise anything about long-term land use without input from the landowner.

Also, if the possibility of environmental service payments makes the land more valuable, the landowner may either increase the rent or discontinue the lease, possibly disrupting the renter's livelihood. In some places where land users do not have title to the land, PES programs have used land tenure security itself as a non-monetary reward for securing an environmental service. For instance, under the HKm program in Indonesia, groups of local farmers have received licenses that provide them secure land tenure, conditional on protecting nearby natural forest and providing watershed services.

Costs of producing environmental services. Costs also determine who can participate in PES programs. Because the price offered for the environmental service is typically the same for all service providers, low-cost providers have an edge over high-cost providers. These costs have two components: direct costs for investment and management, and opportunity costs. Often new land-use practices such as afforestation require high investment to buy tree seedlings and hire labor to plant them. Poor farmers may be unable to invest in these activities. One way to address this problem is to devise a payment schedule that enables the poor to finance their investment costs. In Costa Rica's PSA program, for example, payments for reforestation are front-loaded, with a large proportion of the payment being available in the early years and much smaller payments in later years. PES programs can also negotiate with local credit agencies to help the poor gain access to low-cost financing, using the contract itself as collateral.

The opportunity cost of providing an environmental service is the income foregone from land use that is replaced. For example, putting the land under permanent vegetation to sequester carbon and/or provide watershed services may replace agriculture in the form of annual crops. In this case the opportunity cost of providing the environmental service is the foregone income from agriculture. Experience around the world shows that small farmers usually are more productive than large farmers, partly because they use more household labor, which does not require supervision, and because they can work the land in small increments when it is convenient. Their opportunity cost of time is low, as opposed to the daily increments paid at the market wage. As a result, the opportunity cost for small farmers may be higher than that for larger farmers, adding to the constraints they face in providing environmental services.

Transaction costs. This refers to costs of negotiating, implementing, and monitoring a contract. Elements of these costs are independent of the size of the farm involved, which means PES programs that contract many smallholders face more costs than those that contract with only a few large landowners. Thus PES mechanisms may be less viable where there is a high concentration of very small farms, or service buyers may try to contract with large farmers rather than small ones, which would exclude the poor. Transaction costs play a major role in determining whether PES programs are feasible, and this helps explain why there are many more payment schemes in sparsely populated Latin America than densely populated Asia. Some PES programs have tried to reduce transaction costs by simplifying program design or by developing group-based rather than individual contracts. (Group-based projects do not eliminate transaction costs but effectively transfer them from taking place *between* the buyer and the individual sellers to *within* the group of sellers. Having entered the contract, the group must monitor its members to ensure compliance.)

Programs can also reduce transaction costs by involving local NGOs and other community-based groups as intermediaries. For instance, in the Regional Integrated Silvopastoral Ecosystem Management Project in Nicaragua, Nitlapan, an NGO affiliated with the Central American University, acts as intermediary. It is responsible for field implementation of the project, including organization of local service providers. Intermediaries like Nitlapan help to run the program efficiently and reduce conflicts. Brief 3.4, previously, discusses transaction costs in more depth.

The nature of the environmental service. This often determines whether the poor can participate. In the case of watershed services, once a particular catchment has been identified for providing hydrological services, the program is bound to work with the communities that live in that catchment, irrespective of their socioeconomic status. On the other hand, land users anywhere in the world can provide carbon sequestration services[22]. Poor farmers who depend on marginal lands can provide carbon sequestration services more cheaply than farmers in industrialized countries where land prices and opportunity costs are much higher. Therefore, many carbon projects such as the World Bank's BioCarbon Fund are able to target poor communities for providing carbon sequestration services. Similarly, biodiversity hotspots are predominantly inhabited by the poor, making it easier to target any payment schemes to poor service providers.

Impact on sellers

In the absence of environmental service agreements, land users typically receive no compensation for providing environmental services. This may limit their conservation investments. Service payments can give them a direct incentive, however, to adopt new land-use practices that secure environmental services for downstream communities willing to pay for them. In a voluntary PES scheme, the potential service provider will only accept a payment that

[22] This is an oversimplification, as eligibility for providing carbon sequestration payments does depend on the country where land users live and on the land uses they adopt. However, it is not as restrictive as eligibility for providing watershed services.

meets or exceeds the opportunity cost of investing in conservation.[23] Therefore, payments that land users do accept represent additional income, helping them to improve their economic status. In the case of the Scolel Te community carbon sequestration project in Mexico, an impact study concluded that net present value of discounted benefits (over 25 years) including carbon payments from new forestry management practices were estimated to be in the range of -$110 to +$1,700 per hectare (Tipper, 2002). This would represent modest but significant improvements in incomes for most households that participate in the project. Similarly, the Nhambita Community Carbon Project in Mozambique (Jindal, 2004) is the major source of cash incomes for the local community.

However, it is not necessarily assured that service providers duly understand all aspects of a PES contract and agree to it voluntarily. Local farmers in developing countries are often uneducated and depend on government officials to explain a new program to them. If these officials have a vested interest in the program, they will highlight only its positive aspects and omit the difficult clauses. Service providers thus may be trapped in PES contracts that are not beneficial to them in the long run. PES administrators must ensure that contracting parties understand their obligations well and are in a position to fulfill them voluntarily.

Impact on non-sellers

PES programs affect not only sellers but also non-sellers living in the area. If new land-use practices raise labor demand for these non-sellers, then the program has a positive impact on them. However, a change from seasonal cropping to permanent tress could also reduce demand for labor, which would have an adverse effect on the local poor who depend on farm labor for their livelihoods.

If PES programs are taken up where property rights are unclear, it is also possible that more powerful people may take control of the land, and poor people who have been using it could lose access. For instance, a carbon sequestration project operated by Tree Farms AS of Norway in Bualeba Reserve, Uganda (reference), continues to threaten the livelihoods of the local poor. The company owns a long-term concession to take up plantations over 5,160 hectares of land used for farming, collection of timber, cattle grazing, and fishing by the local people. As these people do not possess formal titles, they face the risk of eviction.

PES-induced changes in land use patterns can also have significant off-site effects. Certain products can become more expensive if their supplies are disrupted. Although biofuels are not covered under PES contracts unless they are produced from woody crops that can also claim carbon sequestration credits, there is a concern that they are fast replacing food crops in many countries, thus raising international food prices. Similarly, PES programs may affect the cheap availability of fodder in local markets by inducing landowners to convert pastures to long-term forests, thus reducing fodder supply. In general, it may be very difficult for a PES program to anticipate all the indirect effects it will have, but it can be cognizant of the major effects, particularly on the poor.

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[23] This may not be true in a group-based program, where a member may have preferred not to join the environmental service program but was outvoted.

Further reading

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This work is intended to be a living document that will be periodically updated and edited. Updates will be available from the project website. For more information or to send suggestions for changes and additions, see http://www.oired.vt.edu/sanremcrsp/pes or contact Michael Colby, USAID/EGAT/NRM, mcolby@usaid.gov

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IMPACT EVALUATION OF PES PROGRAMS

USAID PES Brief 4

Authors

John Kerr and Rohit Jindal[24]

Need for impact evaluation

PES has many attractive characteristics relative to other conservation approaches provided that transaction costs are low and other favorable conditions apply (see sections 2 and 3 of this Sourcebook). However, ascertaining PES's advantages requires measuring the effect of actual programs in the field. Such impact evaluation can also help in identifying opportunities for further improvements in efficiency of these programs and looking out for other environmental services that can find ready markets. For instance, with the feasibility of selling carbon sequestration services through afforestation and reforestation projects clearly established, researchers are now looking for ways to sell carbon credits from avoided deforestation.

The technical and social complexities of payment for environmental services make impact analysis challenging. Spatial interlinkages, difficulty of perceiving environmental services, the long gestation of benefits, and the multiple objectives of some PES efforts all complicate matters. Many impact studies are therefore either anecdotal or based on a small sample size. Studies that only include PES participants in their sample tend to suffer from selection bias. Further, only some studies have access to baseline information, while many others depend on recall method. This can lead to incorrect inferences about the impact of a PES initiative. The objective of this brief is to suggest some ways of doing impact evaluation studies that can adequately reflect what is going on in the field. This section begins with a quick review of what impact studies should measure.

Impact on environmental services, users, and providers

The overall objective of a PES program is to secure an environmental service by paying for it. Sustainability of a PES initiative is thus directly contingent on establishing the link between the payment and the service delivery. An impact study should therefore be able to measure the level of an environmental service that is available with and without the PES program to establish additionality. For some services such as carbon sequestration, measuring this change is relatively easy. Changes in biomass for a particular tree species are multiplied using known carbon content to calculate the sequestration rate in tons of CO_2 annually. Scenic beauty, on the other hand, is much more difficult to measure, for users vary in their perceptions of it[25]. Biodiversity and watershed services lie between the two. Vegetation type, number of endemic species in an area, and number of different species per unit of area are some of the indicators that can be used to measure changes in biodiversity. Similarly, reduction in sediment flow, rise in groundwater table, and increase in dry-season flow can be used to verify the impact of a watershed

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[24] Department of Community, Agriculture, Recreation, and Resource Studies, Michigan State University

[25] The difficulty in measuring an environmental service here refers to the challenge in developing an objective scale, rather than the cost of measuring. Measurement costs are covered in detail in Section 3.

conservation program, depending on what specific service is being sought. In general, the more objective an indicator is, the easier it is to determine the change in the level of the service.

While it is desirable and ultimately necessary to make direct measurements of changes in environmental service indicators (e.g., changes in water flows, water quality parameters, or wildlife numbers) to determine if service providers are obtaining their purchased services, indirect indicators are often used in the short-term for compliance monitoring and measuring implementation progress. Indirect measures are necessary for management purposes because they measure implementation progress during the period in which the ecosystem is being restored and before the ecosystem is capable of delivering the desired ecosystem services. Indirect indicators include measures such as: illegal snares and firearms surrendered, hectares of improved management practices implemented, hectares of riparian zones replanted; forest cover, number of conservation plans agreed to, reductions in pesticide usage, etc.

Many PES programs aim to alleviate poverty by providing payments to poor service providers. In case of the Virilla watershed in Costa Rica, an impact study found that PSA payments led to a 15% increase in the average disposable income of a household. However, a major concern for PES programs is whether poor people can actually participate in a program. For instance, several research studies indicate that, even though Costa Rica's PSA program is beneficial to those poor people who participate, the payments still tend to go disproportionately to the better-educated, wealthier owners of larger farms and forest areas, who are better diversified into non-farm, income-generating activities.

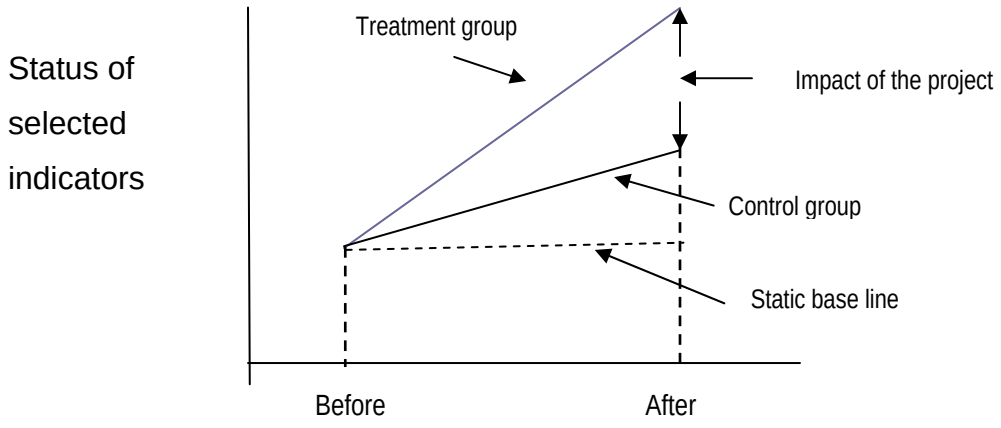
Finally, impact studies should also be carried out to understand the economic value that buyers derive from the environmental service being secured by a PES project. In some cases such as carbon sequestration services, the economic value is easily known by comparing it with international carbon prices. However, in the case of biodiversity conservation or watershed protection, this value needs to be estimated through specific studies. For instance, a downstream dam may gain from reduced silt load due to watershed protection upstream. The economic value can then be calculated in terms of reduced maintenance cost or the increased availability of water for hydroelectricity or irrigation (see USAID PES Brief 3.2, "Valuing Environmental Services," for examples of such studies). Besides such valuation techniques, impact evaluation can also focus on perceptions and attitudes among service users on the level of the environmental service generated through the program. In Ecuador's Pimampiro watershed, for example, many service users felt that it was necessary to protect upstream forests to generate downstream water services, with more than half of the respondents willing to pay more for it.

Quantitative evaluation techniques

Quantitative evaluation begins with the premise that the analyst fully understands the nature and determinants of a program's success and can obtain the data needed to measure and relate them statistically. To the extent that it is feasible, quantitative evaluation attempts to attribute changes in various outcome variables to a project intervention or "treatment" and determine whether such effects are statistically significant.

The ideal situation involves an *ex ante* experimental design, complete with randomization of project beneficiaries (e.g., individuals, villages, or project sites) across treatment and control groups. The randomization process has the effect of creating groups that may be considered equal in all attributes, both observed and unobserved, with differences in outcomes attributed to a project. It removes the possibility of sample selection bias, an analytical problem that arises when systematic, preexisting differences between program and non-program locations are correlated with project participation and the outcome variable of interest.

However, random experiments may not always be possible for PES programs, for choice of sites and participants is often determined by technical criteria. As a result, many evaluations have proceeded with non-randomly determined treatment and control groups, using a variety of quasi-experimental approaches (modeled on experimental approaches). In a before-after study, for example, the evaluator measures the levels of the environmental service before and after an intervention. This requires setting up a base case scenario for indicators that directly relate to the project activities and tracking changes in these indicators to measure the impact of the project (see the figure below).



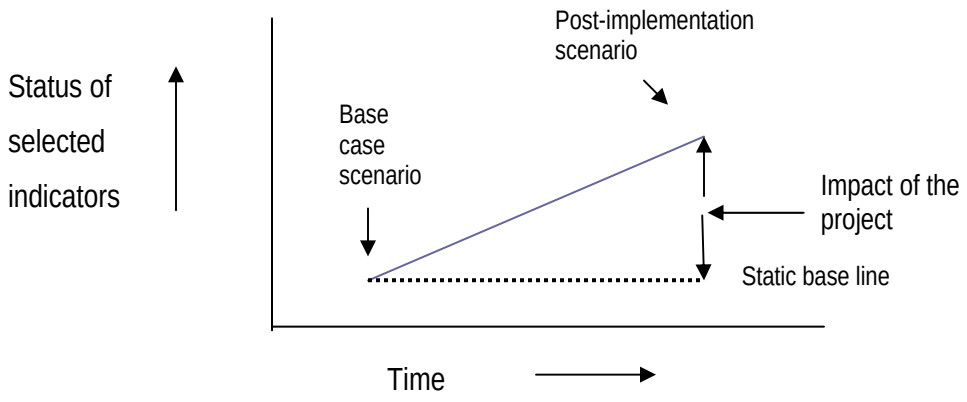
Using a control group to measure project impact

For instance, a study of the Scolel Te carbon sequestration project in Mexico found that discounted benefits for most participants were in the range of -$110 to +$1,700 per hectare. However, this method only calculates the impact with respect to a static baseline, based on the unlikely assumption that there have been no other significant changes during the study period. As a result, it often gives biased results.

Sometimes no baseline data are available, for example, when an evaluation is commissioned after a project has been implemented or the project scope has changed over time. In such cases, researchers can measure only the current state of indicators and must trust respondents to recall the historical status of these indicators. In this case, a with-without design can be useful. To limit sample selection bias, the evaluator must find a control site similar to the treatment sites on as many factors as are hypothesized to affect the outcome.[26] In practice, this is difficult.

Evaluators often suggest a third approach that combines the before-after and with-without approaches. This difference of differences or double difference approach calculates the difference between control and treatment groups at baseline and post-intervention. It has the advantage of "differencing out" any time-invariant unobservable factors that might cause sample selection bias, but it too requires *ex ante* data (see the figure on the next page).

[26] A statistical approach called instrumental variables is used to correct for selection bias in this case. Alternatively, a statistical technique called propensity matching models the probability that each site participates in a project as a function of all observable variables known to affect participation, then matches pairs of participating and non-participating sites that have an equal probability of having been selected for the project. Project impact is estimated as the mean of the differences between all matched pairs on the outcome variable.



Concept of measuring the impact of a project

This approach has been used in the Nhambita Community Carbon Project in Mozambique, where the project has established baselines for the treatment group (Nhmabita) and two control groups (Boa Maria and Munhanganha). The project plans to trace the changes in the three communities over time.

Many studies may lack the time or budget required for careful measurement and must rely on respondents' or investigators' perceptions. For example, one of the impact studies on the Catskill-Delaware watershed protection program to improve water quality in New York measured the perceptions of service providers about their socioeconomic status. The study found that 44.3% of the respondents felt that the program had improved their economic status, while 48.6% felt that it had no effect on them.

Qualitative evaluation approaches

Quantitative approaches provide measured outcomes with statistical tests that support the validity of the findings. But conclusions drawn about a given project are always subject to context-specific conditions. Qualitative methods provide the means by which this context can be understood and may be used to uncover important aspects of a project. Qualitative researchers typically place less emphasis on measurement and more on the process and on understanding the subtle manifestations and determinants of project success, usually by tapping the diverse perspectives of multiple stakeholders. A qualitative analysis is less likely to worry about the applicability of specific outcomes to other project sites, but rather to focus on generalizable 'lessons learned' that may be applied to other projects.

There are many approaches to qualitative evaluation, but they all tend to be flexibly structured and use open-ended questions in an inductive fashion. The objective is not to obtain a numerical estimate of some phenomenon but to develop an in-depth understanding of an issue by probing, clarifying, and listening to stakeholders discuss a topic in their own words. The in-depth nature of the qualitative approach means that a study's scale is usually smaller than in quantitative research, and that the researcher must collect the data rather than hire enumerators. Proponents of a qualitative approach maintain that insights into social processes such as those arising in PES cannot be inferred from measurements of predetermined outcome variables. Rather, the way to understand them is to suspend one's assumptions about how change occurs and learn from the people who actually experienced a project and its effects. Qualitative evaluators aim to uncover the perspectives of multiple stakeholder groups, learning firsthand about the motivations and dynamics behind decisions and actions taken as a result of a project. More than quantifying outcomes, qualitative evaluations emphasize understanding the processes involved in a project.

For example, in a recent study in India examining the feasibility of linking community forestry projects to international carbon markets, open-ended discussions with community members and NGO officials revealed residents' strong fear that they would lose access to public forest lands if carbon payments were introduced. This demonstrated constraints that a quantitative investigation would have missed.

Mixed methods

Quantitative and qualitative evaluation methods historically have been used separately, but recent years have seen a growing interest in combining the two. The rising interest in combining methods comes from the recognition that both quantitative and qualitative approaches to program evaluation have limitations, and that the strengths of each often compensate the weaknesses of the other. Quantitative approaches are most useful when it is necessary to know the magnitude of a particular effect and when the effect is surely measurable. They are less useful when comparable treatment groups cannot be constructed or when the technical assumptions of the analytical models are not met. Qualitative analysis can provide information about important effects that are not known *a priori,* about the processes that link cause and effect, and about how beneficiaries see the impact.

Mixed methods designs can vary significantly in their structure. Qualitative and quantitative components may be used sequentially, in parallel, or in an integrated fashion. Two main classes of mixed-method designs are 1) a component design and 2) an integrated design. With the component design, qualitative and quantitative methods are used in discrete aspects of a study and are combined only at the level of interpretation or conclusions. Qualitative methods might focus on what actually happened in a project, while quantitative methods might focus on the impact. By contrast, an integrated design mixes methods and allows information collected from one activity to inform data collection for other parts of the study, for example, with ongoing qualitative site visits interspersed into a quantitative evaluation study. Conflicting evidence from the qualitative interviews and the survey would signal that the survey needs improvement. Information from qualitative interviews could be used to revise the survey for later rounds.

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THIS WORK IS INTENDED TO BE A LIVING DOCUMENT THAT WILL BE PERIODICALLY UPDATED AND EDITED. *Updates will be available from the project website. For more information or to send suggestions for changes and additions, see http://www.oired.vt.edu/sanremcrsp/pes or contact Colby at mcolby@usaid.gov*

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POLICIES AND INSTITUTIONS: ENABLING FACTORS FOR PES

USAID PES Brief 5

Authors

John Kerr and Rohit Jindal[27]

Introduction

This brief examines policy and institutional issues that are important for PES. It addresses various aspects of the local policy environment, institutional issues related to property rights, collective action, and issues of public sentiments and norms that may influence the feasibility of a PES approach.

Institutions refer to both the formal and informal rules and norms that govern human interaction. Examples of institutions are laws, markets, property rights, and unwritten social norms, and of course they play an important role in developing PES mechanisms, enabling them to function, and ensuring that they help or do not hurt poor people's interests.

Property rights

Property rights as a prerequisite for PES. Property rights play an essential role in payment for environmental service schemes. Environmental services emanate from land use, and payment for environmental services involves paying land managers to utilize the land in ways that provide the desired environmental service. Because PES arrangements are contractual and because they typically require land-use changes over the long term, they normally require an arrangement with the landowner. If land rights are unclear, it is difficult to identify service providers who can guarantee provision of environmental services in exchange for payment. This helps explain why, for example, only landowners are eligible to participate in Costa Rica's national PES program.

In principle, PES arrangements could be undertaken with communal land holders if the communal land holders can credibly provide environmental services. In fact, group-based PES mechanisms help reduce transaction costs associated with setting up and enforcing contracts with large numbers of smallholders. In such a case, a significant portion of the transaction costs are borne within the communal group as opposed to between each individual provider and buyer. The transaction costs among group members may be more or less manageable depending on the context and the characteristics of the group. One potential problem would arise if payment for the service is made in cash, for there is potential for the payment not to be distributed fairly. If the payment or reward comes in some indivisible form that benefits all local people, then this is not an issue.

[27] Department of Community, Agriculture, Recreation, and Resource Studies, Michigan State University

Various scenarios can be imagined when property rights are insecure but a PES arrangement is desired. It could be that the demand for environmental services could stimulate an effort to strengthen property rights systems to facilitate environmental service agreements. On the other hand, if poor people manage land without clear property rights, the prospect of PES could make the land more valuable and lead more powerful people to claim the land. For example, large landowners might evict tenants who are farming and convert the land to forest or other land use that is eligible for PES. Similarly, powerful groups may acquire previously unattractive common lands that poor people depend on to obtain PES payments. Such problems have been encountered in programs that rehabilitate common lands in India. Also in India, often community lands such as forests and pastures are under the jurisdiction of government departments or local governments. Usually a community has access to use such lands for non-commercial benefits. However, if the land becomes more valuable (e.g., due to carbon plantations) governments may reclaim ownership and the community may lose access.

Property rights as the reward. In many areas of the world, the state claims rights over land on which inhabitants are regarded as illegal squatters, even if they have been on the land for generations. In such cases, it is possible to offer land users secure land tenure as a conditional reward for providing environmental services, either in place of or in addition to cash payments. In Indonesia, a social forestry program known as HKm (its acronym in the Bahasa Indonesia language) provides groups of land users with potential tenure in exchange for protecting patches of natural forest and providing watershed services. Similar efforts have been made in the Philippines and in forested areas of eastern India where shifting cultivation is practiced. In Indonesia, HKm groups are granted initial five-year probationary permits followed by renewable 25-year permits if they meet program requirements. One concern about such an arrangement is that, while the threat of revoking land tenure rights may be realistic in the early years, after 25 years the threat of eviction may not be politically plausible. For that reason, some observers have suggested that other reward mechanisms could be tested that are more easily revoked, such as a bonus to the local government budget for providing public services. .

Environmental service agreements create new property rights. Property rights generally are limited. Often the rights to use privately owned land come with the responsibility to use it in socially acceptable ways. PES arrangements may change the bundle of rights and responsibilities associated with landownership. In particular, PES is contrary to the long established “polluter pays” principle, which says that people have the right not to be subjected to pollution. A PES arrangement, on the other hand, implies that land users have the right to use the land as they please, and if others do not like the negative externalities that this land use imposes, they must pay the land user to change his or her practices. The logic behind such an arrangement is twofold. First, long-established land uses may have incremental, offsite effects that become a problem only as the numbers of both land users and environmental service users reach critical thresholds. In such cases it seems fair that long-established behavior should not suddenly become outlawed. Second, in many cases restricting certain types of land use is often unenforceable and create animosity with local land users. Still, there is a grey area in trying to determine when land users should be rewarded for providing an environmental service and when regulations can be used to prohibit pollution producing activities.

Social norms

Offering payment to ensure that essential environmental services are provided is a revolutionary change. The idea of paying for what has always been available free of charge may strike some consumers as distasteful or unfair. As discussed earlier, PES appears to turn the polluter pays principle (PPP) on its head. Under PPP, people have the right to expect environmental services and a landowner who pollutes the environment must pay a penalty for disrupting that right. Under PES, the landowner has the right to pollute and may continue to do so unless offered a sufficiently high payment to encourage a change in land use.

Establishing a cultural acceptance of willingness to pay for essential but increasingly scarce environmental services will be required before PES can spread very far. Most likely such acceptance will spread with the increasing scarcity of certain environmental services and the understanding that they cannot be taken for granted.

Laws and PES

Changes in laws can facilitate the development of PES mechanisms, which in turn have their own legal implications. A good example is the Kyoto Protocol, which made carbon emissions reduction mandatory in signatory countries, unleashing demand for carbon credits. Kyoto allows only limited carbon credits from carbon sequestration, but if this limitation were relaxed, large numbers of landowners in developing countries would be eligible to receive payments for carbon sequestration.

A corollary point is that PES mechanisms may work in tandem with other approaches to environmental management while in other cases PES may be instituted in place of a regulatory approach. For example, the Kyoto Protocol facilitates payments for carbon credits because a regulatory mechanism created the conditions that stimulated demand for PES. Other legal issues will certainly arise, such as the need for mechanisms to ensure that contracts are honored by both buyers and sellers, and systems for dispute resolution.

There is also a risk that PES can create perverse incentives for people to cause negative externalities in the hope that they can subsequently extract payment for refraining from doing so. Strict laws will be needed to discourage this kind of “greenmail” from happening, perhaps by clarifying the practices that are acceptable and not acceptable. Researchers at ICRAF use a traffic-signal analogy whereby a red light signifies land uses, such as dumping toxic waste, that are strictly prohibited; a yellow light signifies those that are to be discouraged by fines and restrictions even if they are not strictly outlawed; and a green light signifies perfectly legitimate land uses such that, if others wish them to stop these land uses, they would have to pay for the privilege.

PES systems depend on location-specific conditions that can best be understood by local environmental service users and potential suppliers. This implies the need for laws that are flexible enough to allow local parties to develop their own solutions to environmental problems. The city of Heredia, Costa Rica, needed an exemption from Costa Rican laws to establish its innovative PES arrangement, which operates outside the national program.

Collective action

Collective action is often an important feature in successful natural-resource management, particularly for high exclusion cost (common pool) resources that cannot easily be managed individually. Cases where collective action matters for PES follow.

Watershed services are subject to threshold effects. Protecting a watershed requires adoption of watershed protection practices on a critical mass of the watershed; isolated adoption would not provide the environmental service. In such a case, watershed inhabitants must act collectively, providing the environmental service as a group. Buyers of the watershed service would have to contract the group of watershed inhabitants as a whole. Watershed inhabitants would have to jointly police each other to protect against free riding, and they would have to jointly divide up revenues from the environmental service payment.

Even for carbon sequestration, where the service is delivered on individual parcels of land, collective action may be needed to reduce the transaction costs associated with establishing contracts, monitoring compliance, and making payments to individual providers. For example, large carbon buyers around the world cannot efficiently contract with small farmers unless they band together as a group to control transaction costs. Intermediary organizations can facilitate the relationship between the large buyer and the group of farmers. If environmental service providers operate as a group, they will also have greater bargaining power than if they act in isolation, and this can help ensure pro-poor arrangements.

Further reading

Brent Swallow, Ruth Meinzen-Dick, and Meine van Noordwijk. 2005. *Localizing Demand and Supply of Environmental Services: Interaction with Property Rights, Collective Action, and the Welfare of the Poor*. CAPRi Working Paper 42. Washington, D.C.: IFPRI. 2005.

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ALTERNATIVES TO PES FOR SECURING DELIVERY OF ENVIRONMENTAL SERVICES

USAID PES Brief 6

Authors

John Kerr and Rohit Jindal[28]

Introduction

Environmental services can be thought of simply as positive externalities: benefits that accrue to people who do not pay for them, supplied by people who are not compensated for doing so. This helps explain why environmental services are often undersupplied and why there is interest in developing mechanisms to secure their delivery.

A variety of approaches

Payment for environmental services is an innovative approach to encourage the provision of environmental services and curb negative environmental externalities like water pollution or destruction of biodiversity. However, by no means is PES the only approach; in fact, it is simply a new approach and one of many available tools available to encourage private land users to provide environmental services. Other approaches include moral suasion and social conventions, regulatory limits and economic penalties, taxes on negative externalities, tradable environmental allowances (permits for negative externalities), investment subsidies, indirect incentives, mergers, changing and/or strengthening property rights and liability systems, and facilitating negotiation and conflict resolution. Many of these approaches can be – and typically are –used in combination. These approaches can be evaluated on the basis of a number of criteria. The choice of criteria is subjective, but a potentially useful set of criteria follows.

Cost-effective and administratively feasible. Solving the problem in a way that is administratively feasible, with low transaction costs, is essential. If transaction costs are too high, the solution may be impractical or more costly than alternatives.

Direct. Economic theory predicts that the more directly a problem is addressed, the fewer side effects with unintended consequences that would raise the cost of the effort or create problems.

Creates strong incentive to comply. Ensuring compliance is essential. Mechanisms that are easily monitored or self-monitoring are the most feasible and cost-effective.

Requires actual compliance. This refers essentially to the conditionality clause of PES, whereby payments are conditional on compliance with the desired environmental outcomes.

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[28] Department of Community, Agriculture, Recreation, and Resource Studies, Michigan State University

Has long-term impact. Favorable approaches should continue to work well over time. Short-term fixes with little long-term effect help explain the long-term ineffectiveness of many natural resource management projects. That said, any instrument (including PES) can be used as part of a transitional strategy to a more sustainable system.

Protects poor people's livelihoods. Given high poverty rates in the world and the stated objective of alleviating poverty, helping poor people or at least not hurting them is essential.

Does not concentrate costs on a particular group. If some people bear disproportionate costs, they may actively undermine efforts to secure environmental services.

Different approaches for securing environmental services (or internalizing externalities) tend to perform better against some criteria than others, so tradeoffs are inevitable. The most common tradeoff concerns potential effectiveness versus administrative feasibility.

Moral suasion and social conventions. Moral suasion encourages private individuals to internalize negative environmental externalities as a matter of doing the right thing. It can include public awareness programs, capacity building and training to promote voluntary changes in behavior, and to some extent a willingness to bear incremental costs to achieve environmental improvements. Moral suasion is used in most environmental programs. While it is direct, cost-effective, potentially self-enforcing, and potentially scalable, it is limited as a standalone approach, especially where it contradicts economic incentives. Changing mindsets and social norms is always a gradual process. One potential problem is that poor land users may find it difficult to absorb higher costs of alternative production systems.

Regulatory limits and economic penalties. This approach includes conventional command-and-control systems for air or water pollution, particularly for highly toxic pollution. This approach has been used for requiring soil conservation investments, prohibiting cultivation on steep slopes, and evicting people from wildlife sanctuaries. Command and control is a very direct approach, and fines and other penalties can induce compliance. It can be hard on the poor if their land uses are restricted. Incentives for compliance are high only with effective monitoring and enforcement. In developing countries, weak monitoring and enforcement can undermine this approach, especially in rural areas where regulatory capacity is limited.

Taxes on negative externalities. Another approach is for the government to introduce corrective taxes that alter the incentives for activities that cause externalities. Taxes increase the private costs of the activity to reflect the social costs imposed on others. A tax equal to the marginal cost of environmental damage from the externality raises the cost of production, causing an increase in price and reduction in demand. Production will decline to match the change in demand, thus reducing environmental damage. Taxes raised can then support improved monitoring and enforcement in a regulatory command-and-control system. A tax on negative externalities follows the "polluter pays" principle as opposed to banning the polluting activity. This approach works in theory, for it is direct and conditional; but it is not practical as a matter of widespread policy in rural areas of developing countries because equating the tax with the externality is difficult. On the other hand, it is somewhat analogous to user fees for scarce natural resources where overuse risks degradation and externalities. The latter is sometimes used at local levels in rural developing country contexts.

Tradable environmental allowances (permits for negative externalities). In this approach, the responsible authority sets a target level of allowable emissions based on an ambient environmental quality standard in a given geographic area. Discharge rights equivalent to the total allowable emissions are allotted or auctioned to individuals or companies through permits allowing the owner to discharge a specified amount of pollution. Anyone producing emissions below the permit allocation through

improved environmental management or reduced production can then sell the excess pollution rights to others who wish to exceed their emissions allocation. In this approach, unlike taxes and subsidies, authorities do not need to estimate private marginal abatement costs and set an efficient tax or fee. With tradable permits, the market determines the optimal price for a unit of emissions. This approach has shown great success in reducing sulfur dioxide emissions from U.S. power plants and has been integrated into the Kyoto Protocol It contains an element of PES in that high polluters can pay others to secure environmental services on their behalf. At the local level, it is analogous to approaches where households are given permits to use scarce natural resources and can trade those permits with others with higher demand for them. It is both direct and conditional but not universally applicable.

Investment subsidies. Subsidies have long been used to change behavior and encourage adoption of alternative management practices. For example, subsidies to adopt soil conservation or plant trees are common in government programs worldwide. Given an initial lack of congruence between private and social gain, subsidies aim to ensure that the private benefit (including the subsidy payment) exceeds the private cost. Subsidies for soil conservation and afforestation have a poor performance record because the payments encourage initial adoption but not continued maintenance of the environmentally favorable behavior. Everyone is familiar with examples where trees are planted under a program subsidy but then do not survive. Subsidies are direct but lack of conditionality limits their effectiveness.

Indirect incentives. Indirect incentives are often used in natural resource management projects in the form of food, employment, provision of inputs, access to credit, and rights to use other resources. After the widespread failure of regulatory approaches to protect natural areas, beginning in the late 1980s new programs offered local people development benefits in exchange for protecting nearby natural areas. Called Integrated Conservation and Development Programs (ICDPs), they aimed to develop other livelihood sources and make exploitation of natural resources less attractive. This approach has not enjoyed widespread success, likely because it is neither direct nor conditional. In particular, short-term project employment and various non-land-based development measures such as skills training and credit provision have no conceptual link to beneficiaries' natural resource-use decision. As with subsidies, they lack conditionality and may even encourage in-migration that only adds to the pressure on the resource in question. This approach can help the poor but without securing environmental services.

Mergers. The classic textbook example of externalities involves a paper mill on a river that pollutes a fishery downstream. If both economic activities were merged or undertaken by a common owner, the joint production decisions would account for the impact of mill water pollution on fish production. An efficient solution would have the marginal cost of pollution abatement equal the marginal benefits of improved fish production; the externality would be internalized because the owner would bear the cost of all pollution. While a pure merger is unrealistic in most settings, a simpler version of the same idea is to share the costs and benefits that come from providing the environmental service. The Sukhomajri watershed in India is an unusual example in which this approach has worked. This approach is closely analogous to PES. It is direct, but it is only conditional if the potential losers have some sway over the potential winners so that they can stake their claim. It can work if benefits are high enough that there is plenty to go around.

Changing and/or strengthening property rights and liability systems. The creation and enforcement of efficient property rights can contribute to internalizing externalities if coupled with an effective legal system where damage from off-site third parties can be addressed through the courts. This system certainly works to some degree in most developed countries. However, in many developing countries, property rights in rural areas are poorly established. Further, the legal system may not be robust, objective, or above corruption. In any case, strengthened property rights and liability systems can be a strong component of any natural resource management strategy.

Facilitating negotiation and conflict resolution. In many local settings, securing the delivery of environmental services requires resolving conflicts and negotiating solutions above all. Third parties may be able to facilitate these processes, taking care to protect the interest of weaker parties that may not be able to negotiate for themselves. This is commonly a component of natural resource management programs around the world.

An example from watershed projects in India

India's national watershed management program invests nearly $1 billion annually. The most widespread approaches for encouraging provision of watershed services are investment subsidies and indirect benefits such as temporary employment. Less common approaches, more frequently pursued by the best NGOs, are moral suasion, building local organizational capacity and facilitating negotiation, and locally implemented restrictions, fines, and user fees. Adaptations of PES and mergers are found only rarely. Key points regarding these approaches and their application in India follow.

Awareness and moral suasion are always favorable components but insufficient on their own.

Effectiveness and scalability often are inversely related. Investment subsidies and indirect benefits such as project employment are administratively simple and easily scalable but ineffective. Mergers, payment for environmental services, cap and trade, and negotiation among affected parties are potentially effective but less scalable due to high transaction costs. Exceptions to this inverse relationship are moral suasion and strengthening legal systems, both of which can be achieved only gradually.

Employment and investment subsidy approaches are the most commonly used in Indian watershed projects. This appears to result directly from their being more easily administered and scaled-up compared to time-consuming investments in better planning, training, and negotiation that better address externalities.

Making payments performance-based could be a critically important innovation. Subsidies for conservation are direct and scalable, but they are unlikely to be effective unless they are contingent on performance. Payments linked to whether a pasture is being regenerated or trees are growing would be feasible and could be monitored through remote sensing. This would make subsidies more like PES. One challenge is that many Indian watershed projects double as employment programs for which funding could not be linked to performance.

Internalizing watershed externalities while helping the poor is difficult. The poor appear to gain in the short term from approaches like project employment, but this does not effectively address watershed externalities. Approaches that best address externalities have little effect on the poor and are difficult to implement. Legal support will be needed for some of the more innovative approaches such as various forms of mergers, which could help the poor but only if net benefits are sufficient to go around.

Greater local institutional capacity helps all approaches, so continued efforts to strengthen organizational skills and local governance systems, and facilitate negotiation are helpful. These are major focal areas of many rural development programs in India.

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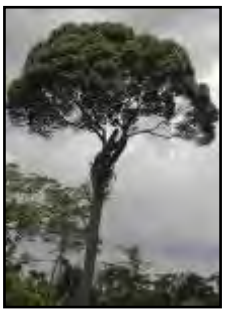

PAYMENTS FOR WATERSHED SERVICES REGIONAL SYNTHESES

USAID PES Brief 7

Authors

Theo Dillaha[29], Paul Ferraro[30], Marjorie Huang[31], Douglas Southgate[32], Shyam Upadhyaya[3], and Sven Wunder[33]

Introduction

As part of the USAID/EGAT/NRM-funded Payments for Environmental Services (PES) Associate Award, regional reports on PES activities, with a focus primarily on watershed services, were developed for Africa, Asia, and Latin America (Ferraro, 2007; Huang and Upadhyaya, 2007; Southgate and Wunder, 2007). This brief is a synthesis of the three regional reviews of Payments for Watershed Services (PWS). Payments for Watershed Services and PES are used somewhat interchangeably, but it should be recognized that PWS is actually a subset of PES where watershed services are at least one of the environmental services being targeted. This research brief provides an overview of the following PWS/PES issues if they could be characterized for the region:

- Regional trends in PWS implementation.
- Contexts and conditions that shape PWS and PES programs across the region.
- PWS and PES program design elements.
- Regional PWS program challenges.
- Regional factors that influence PWS and PES programs.

To describe PES, this brief adapts Wunder's (2007) definition:

1) There is a well-defined environmental service (e.g., specific changes in peak- or dry-season stream flow at the outlet of a watershed) or a suitable proxy for this service (e.g., hectares of forest conserved);
2) There is at least one buyer of this service or proxy;
3) There is at least one seller;

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[29] Program Director SANREM CRSP, Professor of Biological Systems Engineering, Virginia Tech
[30] Associate Professor of Economics, Department of Economics, Andrew Young School of Policy Studies, Georgia State University
[31] Winrock International
[32] Professor of Agricultural, Environmental, and Development Economics, Ohio State University
[33] Centre for International Forestry Research (CIFOR), Belém, Brazil

4) Transactions between buyer(s) and seller/provider(s) are voluntary; and
5) Payments are conditional on contracted environmental services (or proxies for same) actually being supplied.

Payments for watershed services in Latin America

Payments for watershed services implementation remain incipient in Latin America, albeit much farther along than in any other part of the developing world. This analysis focuses on public policy, institutional factors, and political realities affecting PWS in Latin America. PWS programs featuring all five PES characteristics are rare in the Americas, even though the total number of PES or PES-like schemes (which satisfy most but not all of the five criteria) clearly exceeds numbers in Africa and Asia. One reason why conservation payments have been accepted more readily in Latin America appears to be that rural land tenure tends to be more secure in the region in terms of de facto control over resources. Without this control, users and owners of natural resources are in no position to be reliable suppliers of environmental services. Another reason is that commercializing rights to land use and land management practices is culturally and politically acceptable in much of the region. Major exceptions are parts of the Andes with large indigenous populations, as well as Venezuela.

Among various stock-taking assessments of PES schemes, the most frequently cited is by the International Institute for Environment and Development (Landell-Mills and Porras, 2002). IIED is currently updating its survey of watershed-focused schemes. National-level PES appraisals have been carried out by the Center for International Forestry Research (CIFOR) and its partners for Bolivia (Robertson and Wunder, 2005), Colombia (Blanco et al., 2005), Venezuela (Blanco et al., 2006), and Vietnam (Wunder et al., 2005). A major finding of these appraisals is that few genuine PES initiatives have actually gotten off the ground: Some remained in the planning stage; others were abandoned before implementation. A large number developed into “PES-like” schemes that combine user payments with more conventional project approaches and included three or more PES elements.

The Andes. Due to increasing water scarcity and upstream forest loss, there is a high potential for watershed PES in many parts of the Andes, where mountainous topography coincides in many places with large numbers of water consumers. Nevertheless, receptiveness to conservation payments varies. While some places are fairly open to market-based incentives for water management, others are not. Resistance sometimes has to do with a history of resource usurpation. Also, some people cannot reconcile the fact that water satisfies basic human needs with the reality that hydrologic resources are growing scarcer and hence more marketable – or even that channeling water from its sources to the places where it is consumed is not free, therefore must be financed by either consumers or others. In societies with a strong indigenous culture (e.g., the Bolivian highlands), PES development tends to lag. The same holds for large, closed economies, such as Venezuela.

Incentives are strong in Bolivia to protect watersheds as well as the amenity resources harnessed for ecotourism. However, skepticism is widespread toward the “neoliberal” approach to natural resource management generally and PES specifically. Related to this skepticism are suspicions of disguised privatization of public-access resources, including water. Furthermore, key preconditions for PES, such as secure land tenure, are still lacking in many places. As a result,

most conservation initiatives are properly categorized as customary projects. One PES-like pioneer has been the Noel Kempff project, combining carbon and biodiversity services to protect a forest area threatened by logging, near the Brazilian border. Among the few genuine PES schemes in Bolivia is a small project administered by Fundación Natura, in the buffer zone of Amboró National Park, where irrigator and biodiversity payments are pooled to finance conservation (Asquith et al., forthcoming). Opportunities to use the same approach are more promising in the Andean foothills and the transition to Bolivia's lowlands (Media Luna), where there is less ideological resistance to economic instruments and where irrigated, commercial agriculture and urban water consumers are potential buyers. Various municipalities in Tarija and Santa Cruz are also experimenting with PES-like watershed schemes (Robertson and Wunder, 2005).

Experimentation with PES has been less in Peru than in Bolivia. No projects for carbon sequestration appear to be running, although some are in preparation. As for watershed schemes, the most serious efforts have been in Alto Mayo-Moyobamba, San Martín Department, and in the Jequelepeque and Piura watersheds, where German GTZ and CONDESAN have been working together in the Andean Watersheds Project (Veen, 2007). While negotiation processes have advanced noticeably, a primary obstacle has been to transform willingness to pay on the part of potential service buyers into actual monetary flows (A. Moreno-Díaz, personal communication, January 2007).

No South American nation has a richer PES portfolio than Ecuador, where ideological hostility to conservation payments is less than in Bolivia and Peru. Two pioneer schemes that fit the five-point PES definition completely have been running for years. One is the PROFAFOR carbon sequestration program, which has been operating for a decade (Albán and Argüello, 2002). The other is the Pimampiro municipal watershed scheme. These programs have inspired a new generation of local, self-organized PES schemes, including a municipal watershed project in Celica (Loja Province). Another type of scheme draws on water funds to which customers contribute to finance watershed conservation. However, these funds, which have been established in Quito, Cuenca, and El Angel, finance conservation projects rather than make payments to private providers of environmental services.

Colombia is probably the most advanced Latin American country in terms of creating innovative mechanisms for the financing of conservation. While charging users of environmental services has become widespread in the country, compensating service providers on the ground is still less advanced than in Ecuador. However, many more pilots exist than in the Southern Andes and Venezuela, ranging from the NGO CIPAV's RISEMP silvopastural project for biodiversity and carbon (now extended to watershed services), to PES-like irrigator payments for upstream projects in the Cauca Valley, PROCUENCA's water user-financed reforestation in Manizales, and recent water-user payments to upstream protection in Chaina near Villa de Leyva. A number of other relatively advanced initiatives exist, and a national PES strategy is being prepared that may well give Colombia a leading role in PES implementation in the region.

No genuine PES schemes exist in Venezuela, but in at least one case (La Jabonosa watershed, Táchira) water-user payments are being used for projects, and PES trials are being considered. Hydroelectric payments from the Guri dam have been used for financing fire and deforestation

surveillance in Canaima National Park. One preexisting national program, Subsidio Conservacionista, constitutes a potential legal framework for PES.

In summary, PES in the Andean region is uneven, with Ecuador and Colombia more advanced than Bolivia, Peru, and Venezuela. Some of this variation traces to political-ideological factors. Watershed services clearly dominate other services and demand for the former is on the rise. Other than some trial initiatives in Colombia, all existing schemes are self-organized by buyers, sellers, and intermediaries, with little involvement by the central state. Basically all schemes are bilaterally negotiated deals – not quite markets in which environmental services are bought and sold continually.

Little PES activity has occurred in the Amazon. Payments have been collected from tourism operators in Peru's Madre de Dios region to finance the conservation of scenic vistas (Veen, 2007). A similar scheme exists in Bolivia's Madidi National Park (Robertson and Wunder, 2005). However, the specific mechanics of these initiatives differ from those of pure PES (Ferraro and Simpson, 2005). There has been little interest in the Amazon in payment for hydrologic services, probably because water is abundant in the region.

The Brazilian government has launched the Proambiente program, in which payments are used to promote environmental sustainability in the Amazon. Groups of farmers are contracted to follow land-use plans that feature restrictions (e.g., no clear-cutting or burning); however, specific environmental services are ill targeted. In return, they receive payments from the central government. The program was led by movements representing the rural poor, rather than created to satisfy specific demands for environmental services. Thus, it currently faces severe financing constraints, threatening its continuation.

In other parts of Brazil, carbon initiatives have been implemented. For instance, the Plantar project, financed by the World Bank's Prototype Carbon Fund, aims to provide economic incentives for sustainable wood supplies for pig iron production in Minas Gerais state (May et al., 2004). Several cities in the southern part of the country have shown interest in PES or PES-like schemes for the sake of watershed conservation. One of these is the Ecological Value Added Tax (VAT), implemented first in Paraná and later in other states (Grieg-Gran, 2000; May et al., 2002). There are fairly advanced emerging initiatives in the uplands of São Paulo and Rio de Janeiro, and Vitória (Espírito Santo state).

Central America and Mexico. Mexico's Program for Hydrologic-Environmental Services (PSA-H) is the largest PES program in Latin America. The PSA-H focuses on the conservation of threatened natural forests for the sake of maintaining the flow and quality of water. This emphasis reflects mounting water scarcity in Mexico as well as elevated deforestation in many parts of the country (Muñoz-Piña et al., forthcoming). Funding for the PSA-H grew from $18 million in 2003 to $30 million in 2004, derived from charges paid by federal water users. Consistent with the program's basic purpose, monies are disbursed to individual and collective landowners possessing natural forests that serve watershed functions. Payments for preservation of cloud forests ($40 per hectare annually) exceed those for other tree-covered land ($30 per hectare annually).

PES implementation is most advanced in Costa Rica and is highlighted by its Payments for Environmental Services (PSA) program, established in 1997. Forest Law 7575 (1996) established four primary purposes for the PSA program: (1) mitigation of greenhouse gas emissions; (2) hydrologic services, including provision of water for human consumption, irrigation, and energy production; (3) biodiversity conservation; and (4) protection of scenic beauty for recreation and ecotourism. The same law established a regulatory framework for contracting with landowners for the provision of these services. It also established the semi-autonomous National Fund for Forest Financing (FONAFIFO) to manage the PSA.

To participate in the PSA program, landowners submit a plan for sustainable forest management, prepared by a licensed forester. Once this plan is approved, specified practices (i.e., timber plantation, forest conservation or forest management) must be adopted, which triggers payments. In 2006, annual payments for forest conservation averaged $64 per hectare. For forest plantations, about $816 per hectare are disbursed over a 10-year period. Recently, payments for agroforestry were added. Although an initial disbursement can be requested on contract signing, all subsequent annual payments require verification of compliance.

To date, the PSA program has been funded primarily with revenues from a national tax on fossil fuels, which averages about $10 million annually. Additional support has included two grants from the Global Environment Facility, a World Bank loan, and a grant from German aid agency KFW. In 2005, a new water tariff came into effect, which increased PSA revenues. In addition, new opportunities exist thanks to forest carbon finance.

Obstacles to PES in Latin America. Two principal factors are believed to be limiting watershed PES in Latin America: uncertain benefits and high costs. Since PES programs were first proposed, doubts have been expressed about their environmental benefits. One criticism is that natural variability in environmental parameters may outweigh the measurable impact of land management changes over the short term (five to 10 years). Furthermore, there is considerable scientific uncertainty over the relationships between land management and environmental impacts.

One reason for this is revealed by an analysis of Ecuadorian laws relating to PES. Virtually all these legal arrangements focus on the central government's ownership of biodiversity and other resources, obviously anticipating sizable international payments for access to these environmental assets. In contrast, existing laws and regulations are silent on the support that the national state should provide to local PES schemes (Corral and Rodríguez, 2006). As a result, the use of PES in watershed conservation remains excessively expensive, therefore is not resorted to as often as it could or should be.

Latin America summary and conclusions. Currently, most relevant operations in Latin America, as elsewhere in the developing world, are PES-like, i.e., not full-fledged examples of the approach. But the number of ongoing and emerging initiatives is much larger than in Africa and Asia combined. Many watershed schemes have failed to cultivate buyers of environmental services, relying instead on one-off contributions from external donors. Others do not feature conditionality, with implementing agencies shying away from the business-like practice of paying only when services are rendered. This reluctance has to do in part with concerns about

disrupting relationships with poor farmers, which suggests that PES development and the alleviation of rural poverty may not be entirely harmonious.

Various things can be done to increase the use of conservation payments. Greater scientific understanding of key hydrologic linkages (e.g., sediment displacement due to natural and human forces) would help. So would the counteraction of strategic behavior through the use of innovative bidding procedures as well as the development of institutional arrangements conducive to collective action. Government policies, such as selling water below its cost, need to be reformed. At the same time, the public sector needs to help reduce scale-dependent transaction costs, which are especially burdensome for small communities and which counter the capture of society-wide benefits (e.g., biodiversity protection) created by watershed protection at the local level.

Beyond coming to terms with specific tasks such as these, one must bear in mind broader reasons why there is often a gap between what PES theorists have imagined in scientific articles and the reality of PES on the ground. One of these is that Latin Americans historically have made use of the natural environment for free – logging, mining, and expanding the agricultural frontier pretty much as they pleased. In light of this history, actually paying for environmental services in response to mounting resource scarcity represents a major change in attitude, which necessarily will take time.

Also, PES implementation is held back in many places because of mistrust by key stakeholders. For example, service-providers – most notably, small indigenous farmers – fear that PES represents a first step toward permanent expropriation of their resources. At the same time, service-users might suspect that they are or will be the victims of “environmental blackmail.” Intermediaries, including NGOs and civil-society elements, sometimes have the confidence of stakeholders needed to overcome perceptional obstacles such as these. The presence of such fair brokers between users and providers of environmental services often catalyzes early PES initiatives, which in turn can lead to scaled-up programs such as the Costa Rican PSA or the Mexican PSA-H. Aside from being trustworthy, these intermediaries also need to be willing to invest the time and effort required for effective negotiations.

As such negotiations are pursued, there is no reason to insist always on one-size-fits-all when applying economic incentives in environmental management, with conditionality and all other features of PES in place everywhere. But while customizing schemes to local conditions may be entirely sensible, we are convinced that payment-initiatives in a number of settings would be more effective if these adhered more closely to all five PES principles. For example, when watershed PES schemes rely exclusively on external sources of support (instead of service-user payments) that will decline sooner or later, then they are bound to be unsustainable. Also, when there is no strong conditionality, service delivery is compromised in most cases. Following a complete set of guiding PES principles, then, is not just a question of academic grace. Instead, doing so directly affects the functionality of conservation payments.

Payments for watershed services in Asia

Across much of Asia, rapid transitions to market-based economies alongside demographic changes are creating an increasingly high demand for watershed services. Standard approaches to

watershed management have largely failed to reverse widespread watershed degradation and protect the watershed services they provide. The past few years have witnessed a surge of interest in the development of PES programs in Asia. A number of donor-driven scoping assessments and action research pilot sites are underway – primarily in Indonesia, the Philippines, India, Nepal, Vietnam, and China – to determine the enabling conditions for establishing PES schemes. The largest number of PES and/or PES-like case studies comes from Indonesia and the Philippines, where watershed management has taken on less of a command and control approach, thus the enabling conditions for establishing PES schemes are greater. Donor-driven poverty alleviation is also being tested as an objective alongside the provision of environmental services. Few "mature" PES programs actually exist in Asia.

Five factors influencing the development of PES programs in Asia are discussed. First, governance structures in Asian countries vary from command-and-control to more decentralized, participatory approaches to watershed management. Such governance structures shape the regulations and the required capacities of local and national-level institutions to support PES. Second, in much of Asia, population density is high and land holdings per household are relatively low, potentially increasing PES transaction costs. Third, most forest and agricultural land in Asia is state-controlled, with individuals or communities possessing weak property or usufruct rights, thus bringing into question the voluntary component of the PES definition. Fourth, as within most developing countries, the lack of hydrologic data to establish a relationship between land-use patterns and environmental services raises issues of how the conditionality aspect of PES is being met. Finally, the level of awareness of the PES concept across Asia is relatively low.

Design and development of PES in Asia. With funding from the International Fund for Agricultural Development (IFAD), the World Agroforestry Centre (ICRAF) has played a prominent role in promoting the concept of both cash and in-kind "rewards" for environmental services with their Rewarding Upland Poor for the Environmental Services (RUPES) program in Asia. RUPES is actively implementing pilot action sites in Indonesia, the Philippines, and Nepal, and establishing learning sites in China and other parts of Asia to test the feasibility of PES to address both environmental protection and poverty alleviation. Also, from 2001 to 2006, IIED conducted scoping assessments in India and Indonesia. With funding primarily from external donors such as Great Britain's Department for International Development (DFID), USAID, and the Ford Foundation, a number of international and local organizations are also exploring the feasibility of PES programs in Asia.

Improved total water yield and seasonal flow augmentation; improved quality of water; and general watershed rehabilitation and erosion control are the most commonly reported hydrologic environmental services demanded and provided under PES programs in Asia. Landslide prevention and flood control are also mentioned as possible services, but no related PES cases were found. While environmental services demanded are based purely on downstream watershed service needs, the actual PES mechanism adopted and whether the schemes fit the five requirements of the PES definition are factors of whether market mechanisms are at work or state regulations are driving watershed management approaches, or a combination of both. In China, providers of environmental services, such as farmers, can opt to participate in the Sloping Farming Lands Conversion Program PES scheme, but the government finances the program,

specifies how the land is to be managed, and farmer participation has not always been voluntary (Sun and Liqiao, 2006). In contrast, in India and Indonesia, individual households or communities participate in decision-making processes to determine how land is managed to provide an environmental service, which is more characteristic of market-based PES programs (Landell-Mills and Porras, 2002).

PES buyers in Asia have included a mix of local and national downstream users:

- State-owned or parastatal hydroelectric facilities or municipal water supply companies directly or indirectly providing cash payments or in-kind rewards to upland communities in return for the provision of reliable water flows and improved water quality, typically reduced sedimentation or erosion (Indonesia, Nepal, the Philippines);
- Private enterprises, such as local water bottling or ecotourism companies, agreeing to pay upstream land users by direct or indirect cash payments or in-kind rewards for the provision of improved water quality or quantity (Indonesia);
- Local community groups, such as water user associations, agreeing to pay upstream users by direct or indirect cash payments or in-kind rewards for the provision of improved water quality or quantity (India); and
- Central governments distributing cash subsidies and in-kind rewards to farmers in return for reduced sedimentation or erosion (China).

By far, municipal water utilities, national and local governments, and hydroelectric facilities are the predominant buyers in the case studies reviewed. Cases of private sector interest (e.g., private bottling companies) in payment for environmental services exist but are not common. In most cases, there is a single buyer.

Overall, there is limited demand from environmental service buyers in Asia, for the general concept is relatively new and potential buyers are not aware of the potential. Furthermore, there are few if any successfully implemented PWS cases; thus, potential PWS buyers are uncertain if payments will provide desired environmental services. Buyers may also require more evidence of scientific linkages between upland land-use management and downstream impacts before committing. Where buyers are already paying various taxes to the national and local government and/or putting funds aside for community development activities aimed at social responsibility, PES is also perceived by some as another unwelcome tax or fee.

Potential service providers are not homogenous across the Asian landscape. In particular, individual farmers may have limited land-use ownership or rights (private, community-owned, state-owned) or be altogether landless. The widespread lack of land tenure is often cited as a key constraint to PES in Asia (Landell-Mills and Porras, 2002; Wunder et al., 2005). As a result, some PES action pilot sites in Asia are experimenting with land tenure or land-use rights as a payment or reward for environmental services (Winrock International, 2005; Suyanto et al., 2005; Leimona, 2005).

Population density and resulting small land holdings in Asia require a high level of cooperation and coordination among land users to secure desired watershed services. Smallholders also typically tend to be poor and are at a distinct disadvantage if a capable or trustworthy

intermediary is absent to advocate on their behalf. In India, watershed development program benefits often go disproportionately to rich landowners rather than the poor (Sengputa et al., 2003), because the poor are less familiar with formal contracts; are poorly educated; and, due to weak property rights, are unable to guarantee that they will be able to provide watershed services (Landell-Mills and Porras, 2002). Evidence also suggests that in some circumstances, marginalized community members and landless farmers could lose access to common areas and experience declining livelihoods unless poverty alleviation is considered in program design. Thus, group-based rewards, such as tenure security for the whole, can potentially improve coordination/cooperation and prevent the poor and weak from being manipulated or expropriated by wealthier members of the group. In fact, in most if not all cases, environmental service providers are ad hoc or formal groups of individuals such as association of water users, farmers, and forestry operators.

Intermediaries – local and international NGOs, research institutes, community-based organizations, and government officials at various levels – play a critical role in linking the providers and the buyers of the environmental services. In Asia, intermediaries provide a range of services: increasing public awareness, serving as a clearinghouse for information, training, capacity building, negotiating, monitoring and evaluation, resolving conflicts, absorbing transaction costs, and conducting scientific and socioeconomic feasibility assessments on the potential of PES in various watersheds. Intermediaries have also helped to generate collective action, providing support for weaker members of communities to better address poverty alleviation or ensure that the poor are not made worse off. Local institutional capacity to provide such services varies across Asia but is generally low. Without intermediaries, the potential of PES at many of these sites in Asia would probably not be realized, at least in the short term.

Developing payment mechanisms with the right incentives to induce long-term behavior change has proved a challenge in the Asian context as elsewhere. The appropriate length of contract, type of payments or rewards, fee structures and targeting, and transaction costs area all factors in determining the incentive package needed to convince potential providers and sellers of environmental services of the benefits from active participation in PES programs.

Typically, contracts between buyers and sellers are initially negotiated for a couple of years with the potential to be renegotiated and extended if a demand still exists once the contract period ends. In China, under the Sloping Farming Lands Conversion Program, contracts to convert farming and barren lands are recognized for up to 50 years, can be inherited and transferred, and can be extended on expiration. Farmers voluntarily convert marginal, sloping farmlands into forests and grasslands in exchange for cash subsidies and/or free grain or seedlings (Sun and Liqiao, 2006). More typical are shorter contracts, such as in the Cidanau watershed in Indonesia, where the company PT Krakatau Tirta Industri (KTI) is voluntarily paying upland communities to maintain forest cover on a 50 hectare pilot site for two years with the possibility to renegotiate and extend for another five years (Leimona and Prihatno, 2005).

Where awareness of PES exists, Asian upland communities have participated in PES schemes for cash payments. Such payments typically flow to a group with established rules, written or oral, on how to manage PES payments/community funds for the benefit of the whole. Rarely if ever is cash transferred directly to individual households.

Several RUPES sites found that royalty distributions per capita for water supply services from hydropower plants were insufficient to affect poverty. For example, in Singkarak Lake, Indonesia, the local community unit received close to $40,000, or only $1 per capita, in 2005 as its first allocation of hydropower royalties (ICRAF, site profile RUPES Singkarak). Similarly, in the Kulekhani watershed in Nepal, payments from hydropower royalties amounted to about $1.50 per capita (ICRAF, site profile RUPES Kulekhani).

Yet local communities do appear to benefit where cash payments are complemented with in-kind rewards such as secure access to land for farming, technical assistance or training, with the potential to lead to additional incomes and benefits. In Vietnam, for instance, the average smallholder farmer received an average annual payment from a pilot PES scheme of $15, making up only 2% of household income. This low payment was attributed to the inability of poor farmers to commit more than 1.5 hectares to the scheme. However, the farmers were willing to participate in the scheme because many were seasonally unemployed, and they valued the forest management training and technical assistance provided (Bui and Hong, 2006). Thus, in designing PES programs, it would appear that some form of layering of payments or rewards is necessary to create an attractive incentive package.

The literature indicates that targeting is not commonly used to direct payments to service providers giving the greatest environmental service benefits. Rather, evidence points to cash being paid mostly as flat fees or flat fees per hectare. While implementing flat fees per hectare is easier to implement, it may be less efficient in achieving desired environmental services. Experiments with differentiated fees based on the level of services provided are few. In one case, in Sumberjaya, Indonesia, a payment scheme is being explored whereby a hydropower facility in Sumberjaya makes payments at different levels based on actual sediment reductions achieved by watershed protection activities (ICRAF, RUPES Sumberjaya). This is an exception, for few Asian PES activities have performance-based monitoring and evaluation components to determine if the intended environmental service is being supplied, in large part due to the lack of scientific data and knowledge linking upland activities with downstream impacts.

Similarly, few socioeconomic poverty indicators are being collected to determine if the poor are benefiting from PES schemes. As a start, the RUPES program has recently prepared baseline indicators to monitor the impact of PES on poverty alleviation in its six pilot sites in Indonesia, Nepal, and the Philippines. However, because poverty is so pervasive in upland areas, the poor may be service providers and thus receive payments or rewards under a PES scheme by default.

Transaction costs are those required to establish and manage a PES program. Such costs can be high where the negotiation process is long; the process of distributing payments is bureaucratic; hydrological data is missing for monitoring purposes; and awareness is low, among other factors. In most of Asia, the capacity of existing local institutions to confront and resolve these challenges is considerably low, thus potentially raising the transaction costs needed to increase capacity. In the few cases that mention transaction costs, evidence indicates that they could hinder PES program success. For instance, one study found that the estimated transaction cost to establish and operate a land tenure rights (HKm) group in Sumberjaya, Indonesia, was about $55 per household. Such costs include covering the time and effort needed to negotiate or prepare,

process, and approve the HKm applications submitted to the local and national governments. Given that the average annual farm household income is $109 or less, this transaction cost was considered excessive (Arifin, 2005). Transaction costs can be lowered if payments are distributed to organizations rather than individual households, particularly where the people-to-land-area ratio is high, as is widely the case in Asia.

No country in Asia now has laws and policies at the national level explicitly and directly supporting PES. Opinions concerning the necessity of PES-enabling laws and policies range from the belief that existing national and local policies are adequate or need only minor modifications to support PES to the belief that entirely new PES-enabling legislation is needed (Padilla et al., 2005; Arifin, 2005). Across Asia, a number of key policies already address ecosystem conservation and protection, revenue generation, and poverty alleviation, providing indirect support to the objectives of PES. However, current legislation does not specifically require that funds be earmarked directly to service providers or that beneficiaries pay for environmental services.

Summary and conclusions. Asian countries are at different stages in exploring the potential of PES programs to provide environmental services. Indonesia and the Philippines have the largest number of documented PES activities, but all of these are still in the testing/pilot program stage. Consequently, only preliminary lessons learned and best practices are available. Key questions in Asia include whether the definition of PES can be broadened to include both environmental service and poverty alleviation goals, and whether PES can exist where governments exercise tight control over land use, as in much of China and Vietnam.

While broader contextual factors, e.g., forms of governance and high population densities, affect the design and implementation of PES schemes in Asia, their feasibility is highly specific to local context. Preliminary evidence indicates that where feasible, PES schemes have the potential to be designed from the start to ensure a higher likelihood of success in Asia.

Payments for watershed services in Africa

Although there has been global experimentation with PWS schemes for almost a decade, only a couple exist in Africa. The two African PWS programs now making payments are both in South Africa. As described below, these two programs are not conventional PES programs; they are essentially public works programs oriented towards securing hydrologic services. Given that the most common definitions of PES services do not include such public works programs (e.g., Wunder, 2007; Ferraro, 2001), one could reasonably argue that there are no PWS schemes now operating in Africa. In addition to the two programs in South Africa, there are at least eight other initiatives in formal planning phases in South Africa, Tanzania, and Kenya. Presentations at recent workshops (e.g., East and Southern Africa Katoomba Group, 2006) suggest that other initiatives are being considered by field practitioners and government agencies, but these have not yet entered a formal planning phase.

For all types of PES, Africa lags other areas of the world. For example, in the global carbon offset market for 2003 and 2004, Latin America and Asia accounted for more than three-fourths of the emissions reduction projects, while Africa accounted for just 3% (Lecocq and Capoor, 2005). The Katoomba Group commissioned PES inventories for Uganda (Ruhweza and Masiga,

2006), Kenya (Mutunga and Mwangi, 2006), Tanzania (Scurrah-Ehrhart 2006) and South Africa (King, Damon, and Forsyth, 2005). These inventories list 18 biodiversity projects (of which two are making payments in cash or in kind), 17 carbon projects (of which five are making payments), and 10 water projects (of which two are making payments). Jindal (2006) lists another 13 nations with carbon sequestration programs, but none of them has more than one project (Kenya, Tanzania and Uganda together have seven). A couple of nations have biodiversity payment initiatives (Madagascar, Guinea). However, no other payments for water service initiatives were identified. Bond (2006) reported that PWS schemes were proposed but abandoned in Zimbabwe and Malawi.

The inventories' definition of what a payment for biodiversity project comprises in Africa includes community-based natural resource management initiatives, ecotourism market participation (e.g., as guides or other tourist service providers), agricultural technology transfer projects, and projects that reward communities with limited access to protected areas. A minority of the listed projects are conditional (performance-based). The Kenyan inventory lists 10 PES projects (one water, one carbon, eight biodiversity) but has a disclaimer: "The projects show elements of PES but may not necessarily exhibit explicit characteristics of the buyer-seller model." A recent workshop, Catalyzing Payments for Ecosystem Services in Africa, further illustrates the paucity of initiatives (East and Southern Africa Katoomba Group, 2006). Of the eight African case studies presented, only one referenced an ongoing PES project.

Most African PES initiatives are funded through overseas development assistance, international conservation organizations and, increasingly, governmental agencies. There is little private-sector involvement. A common refrain at African PES meetings is that somehow conservation and development practitioners must "engage the private sector," which currently is unaware of the substantial purported gains from trade in environmental service contract schemes.

Why so few PWS schemes in Africa? Africa is the most capital-poor, inhabited continent. Thus, not surprisingly, most of its rural populations depend on ecosystem services for their livelihoods. Sub-Saharan Africa includes 11 of the 16 nations of the world having less than 1,000 cubic meters of water per person annually, a situation described as "absolute water scarcity" where food shortages are a constant threat and water shortage can only increase (FAO, 1995). With water so scarce, why are there so few PWS programs in Africa? Frequently cited obstacles to their development there and elsewhere are lack of technical and market information, limited institutional experience, inadequate legal framework, limited successful business models, suspicion of markets for public goods, and equity concerns. Other reasons for reduced PWS activity in Africa are described below.

In general, PWS come from five sources: hydroelectric power suppliers, large industrial users, municipal water suppliers, irrigation water users, and general tax revenues. It is worth mentioning that in most PWS cases in the world, existing revenue streams are being used to make the conservation payments. In only a few cases have rates paid by end-users been raised. Thus the financial health of institutions is an important prerequisite for PWS schemes, a quality for which African institutions are not well known.

Africa generates little electricity by hydropower compared with other regions of the world –less than 20% comes from hydroelectric sources (Lokolo, 2004; United Nations, 2004). In contrast, almost 70% of Latin America's substantially greater electricity production comes from hydroelectric sources (United Nations, 2004). Unlike Latin America and parts of Asia, Africa does not have high hydroelectric potential because so much of the continent has a semiarid climate with periodic droughts. Sub-Saharan Africa has hydroelectric potential of 710 Terawatt hours (TWh), of which 6% was developed in the 1990s. Latin America, in contrast, has 3,280 TWh of potential, of which 12% was developed. The hydroelectric capability of Africa is mainly in its most institutionally weak nations: Democratic Republic of Congo, Cameroon, Ethiopia, and Madagascar (Lokolo, 2004). Moreover, in terms of potential numbers of payers, Latin America has the highest electricity coverage (84%) of any region in the developing world, whereas Africa has the lowest (about 10%).

As with hydroelectric power, Africa also has the fewest public water systems and the fewest citizens connected to them. Thus there are fewer people who can be charged for domestic water. Most Latin American nations have higher rates of urban access to piped water and, more importantly, much higher rates of urbanization. About three-fourths of the Latin American population is urban. In contrast, only 35% of Africa's population is urban (UNDP, 2002).

Furthermore, investing in watershed management is not an obvious priority for African municipal water supply systems. Urban water systems are caught in a cycle of declines in investment, quality of service, and financial returns, characterized by (a) low coverage and unreliable service, (b) high levels of unaccounted-for water and unpaid bills, (c) poor financial management, (d) revenues insufficient to cover operations and maintenance costs, and (e) inadequate commercial management (World Bank, 2001; 2004).

Industrial water users are self-supplied industries not connected to a distribution network. Industrialization is certainly much lower in Africa than in other areas of the world, thus the likelihood of using funds from industrial water users is less.

The final institutional source of PWS financing is general tax revenues, which are much less than in other parts of the world. For example, compared with Latin America, Africa has smaller government budgets (just over half), larger populations (almost double), higher levels of poverty (more than three times higher), and higher rates of government expenditures expressed as a percentage of gross domestic product (GDP), despite the African GDP being much lower. All of these observations imply that Africa has much less capacity than Latin America for drawing on tax revenues to fund PWS programs.

Getting African water users to pay for hydrologic services is made difficult by high levels of poverty. Thirty-four of the 49 least developed countries are African (FAO, 2005). On the other hand, poverty also makes the required payments for PWS lower in Africa than in other parts of the world, for African suppliers' opportunity costs are lower. However, the high-profile development goal to increase Africans' access to safe drinking water makes it politically more difficult to insist that water users pay a higher fee. Even in South Africa, where the percentage of the population with access to safe water is relatively high by African standards, restricting water

access to non-payers is controversial. Because water is a larger portion of their budget, poor residents likely have a much higher price elasticity of demand for water than non-poor residents.

High transaction costs are also barriers to PES development in Africa (Muramira, 2005; Grieg-Gran et al., 2006; Ochieng et al., 2007). Although transaction costs are a problem in all nations (Bellagio Group, 2007), there are reasons to believe that PWS schemes in Africa may be particularly affected by such costs.

Land ownership is much more concentrated in Latin America than in Africa (Lastarria-Cornhiel et al., 1999). Thus in Latin America, PWS schemes are more likely to contract with a smaller number of large landowners, whereas in Africa, they must contract with many small land users/owners. Note that the less concentrated distribution of land in Africa also implies that, should a PWS be feasible, it is more likely to be pro-poor than in Latin America. A PWS scheme is a contract, thus the factors typically identified as curtailing business activity apply to PWS development: regulatory environment, rates of literacy, judicial system, availability of information, trust, and corruption. This is an issue because 25 of the 64 most corrupt nations in the world (Transparency International, 2006) are in Sub-Saharan Africa.

The African land tenure situation is an important barrier to PES development (e.g., Muramira, 2005; Mwangi and Mutunga, 2005; Ochieng et al., 2007). A review of global tenure trends (Lastarria-Cornhiel et al., 1999) indicated that most land in Africa is held under customary tenure that provides access to all recognized members of the community. Thus, PWS schemes in Africa frequently must address multiple sources of formal and informal authority over a given tract.

Customary tenure systems in Africa generally do not permit land sales, particularly to people outside the community. Even leasing can be complicated by tenure insecurity (i.e., someone leasing land could gain rights over it), which makes rental rates higher than they normally would be (Lastarria-Cornhiel et al., 1999). Thus PWS programs, which typically contract for actions that curtail access and use to land, may be more difficult in Africa.

Given the likelihood of multiple property claims, payments in Africa are more likely to be at the community level than the household level. Although there are examples of community-based revenue sharing schemes (e.g., CAMPFIRE in Zimbabwe) and community-based PES (e.g., Nhambita Community Carbon Project in Mozambique), not all African nations recognize customary tenure or communities (villages, village councils) as autonomous legal entities, particularly when the property in question is “wild” forests or wetlands. Even when such tenure systems and local institutions are recognized, designing a community-based contract that induces the required individual behaviors is much more difficult than in situations involving single owners with secure property rights.

Reports on PES related to Africa (Waage et al., 2005; Muramira, 2005; Mwangi and Mutunga, 2005; Scurrah-Ehrhart, 2006) argue that a key constraint is the lack of enabling legal, regulatory, and administration elements. Nations in which there is some PES activity (Uganda, Kenya, and South Africa) have some enabling legislation (Ruhweza and Muhumure, 2005).

In some cases, there may be legislation that explicitly forbids PWS-related activity. For example, South Africa's National Water Act prohibits some activities for which someone might want to make a payment, such as removal of vegetation from a riparian zone or stopping agriculture in a riparian zone (King et al., 2005). In other cases, authority over water and land use may be too decentralized to allow for effective coordination across a catchment (e.g., if water users' associations are defined at the sub-catchment level).

However, no clear case for the lack of enabling legislation being an important barrier to PWS development has been made. In many African nations, there is legislation for channeling user fees (called abstraction fees) to watershed management. There may be weaknesses in the systems (Scurrah-Ehrhart, 2006) and an unwillingness to charge such fees, but the authority to do so exists in many African nations. Indeed, the summary of the East African and South African PES inventories (Katoomba Group, 2006) identifies the lack of supporting legislation as a barrier but notes that "in most countries, policies establishing the right to buy and sell ecosystem stewardship services have not been essential for pilot activity in PES."

A report summarizing PES inventories for East Africa and South Africa (Katoomba Group, 2006) reported that most African countries lacked needed institutional capacity (e.g., certification bodies, financial intermediaries, national registries for ecosystem services, water management agencies, technical capacity) to facilitate PES, and this increases transaction costs.

Lack of awareness of PES and the capacity to design and implement PES schemes have also been identified as critical barriers to PES development in Africa (Muramira, 2005; Mwangi and Mutunga, 2005; Katoomba Group, 2006; Ochieng et al., 2006). The concept of PWS schemes is relatively new and, given the constraints on information transmission in Africa, one would expect PWS development to be slower than in other parts of the world.

PWS insights from South Africa. Given the barriers to the development of PWS listed above, it should come as no surprise that the majority of African PWS activity is taking place in South Africa. Relative to the rest of Sub-Saharan Africa, South Africa has a better business climate, higher income levels, greater scientific capacity, better understanding of the nation's hydrology, greater institutional capacity, a stronger national water law that makes provision for the use of economic instruments in water management (Act No. 36 of 1998), and higher rates of access to safe water.

In its two operational PWS programs – Working for Water and Working for Wetlands – South Africa has managed to address the imperative of assisting the poor and circumvent the problems that arise from complex tenure systems. They have done so by adopting a public works program approach that allows targeting of benefits to the disadvantaged and avoids contracting with land users (i.e., focuses on government lands). This approach also leads to broad national support for the programs. Moreover, the contracts in these programs are for activities for which compliance is relatively easy to monitor (removing invasive plant species on a plot of land or rehabilitating a wetland).

Summary and conclusions. The paucity of on-the-ground PWS initiatives precludes a definitive discussion of an African PWS model or regional PWS trends in Africa. Nevertheless, there are

some common elements of existing and proposed African PWS initiatives. First, and most importantly, poverty alleviation and equitable wealth distribution are key objectives in most African PWS projects. In Africa, poverty alleviation and services are viewed as equally valued joint products of PWS schemes, or the provision of watershed services is viewed as merely a co-benefit of the poverty alleviation scheme (e.g., Working for Water Program). The implied social targeting that comes with a focus on poverty alleviation will likely increase the transaction costs and decrease the level of watershed services provided by PWS in Africa. The appeal of a PWS scheme that provides employment benefits may explain the African interest in the potential role of PES to restore degraded ecosystems (Ruhweza and Muhumure, 2005).

The two existing PWS programs in South Africa depend on general tax revenues for financing. The choice of such financing stems from a strong program emphasis on economic empowerment and poverty alleviation rather than ecosystem services, and from the political controversy associated with raising water prices in a poor nation. The planned programs in Africa are hopeful for financing from water users, but none have secured such a funding source. South Africa's WfW program shows that the dichotomy some PWS proponents make between public payment schemes and self-organized private deals is not a strict one: The government can maintain an institutional infrastructure through which individual beneficiaries of ecosystem services (e.g., private companies) can make their payments to service suppliers.

Another argument frequently made in the PES gray literature and presentations is that tax-financed PWS programs are inherently less cost-effective than private payment programs. However, given that most water and hydroelectricity suppliers in Africa are government-run or regulated private entities, there is no reason to believe they will be any more cost-effective. Even when the buyer is a private enterprise, the fact that many such entities engage in these deals for reasons of corporate social responsibility and reputation also suggests that they may be no more cost-effective than tax-financed initiatives.

In conclusion, for all of the reasons discussed above, there will likely be fewer PWS schemes in Africa than elsewhere. However, these barriers to PWS development do not imply there are no opportunities for PWS. There are already a couple of large-scale initiatives and a number of incipient initiatives that may succeed in establishing PWS schemes. Further experimentation and information-sharing over the next five years should offer a clearer picture of the potential for PWS to achieve environmental and social objectives on the African continent.

Summary and conclusions

Payments for watershed services and PES programs in general are being promoted as an alternative to standard conservation programs in some circumstances. The hope with PES is that it will provide new revenue streams for protection of environmental services and that, through the use of market mechanisms, it will be more effective in achieving environmental goals. True PES programs as defined by the PES researchers involve:

1) A well-defined environmental service or a suitable proxy for this service;
2) At least one buyer of this service or proxy;
3) At least one seller;
4) Voluntary transactions between buyer(s) and seller(s); and

5) Payments conditional on contracted environmental services or proxies for same actually being supplied.

Also, poverty alleviation is commonly added as an objective by many development practitioners. PWS and PES programs featuring all five PES characteristics are exceedingly rare in the developing world. Most PES activities reviewed were actually proposals or scoping/research studies, and a significant number of proposed PES schemes had been abandoned, although new proposals have correspondingly emerged. Most PES programs reviewed did not satisfy all five PES criteria. Poverty alleviation was often an additional stated goal. PWS and PES programs are the most advanced in Latin America and the least advanced in Africa, which has only two watershed service programs with PES-like elements. Identified factors that tended to promote successful PES programs included secure land tenure; technical capacity to design and manage programs, including layering financial and non-financial incentives; the presence of fair brokers acting as intermediaries between buyers and sellers; higher standards of living; countries with high urban populations and a need for improved water resources; countries in which commercializing rights to land management is culturally and politically acceptable; countries with PES-enabling legislation; and countries with good governance. These factors are generally most positive in Latin America and least positive in Africa.

For more information on the state of PWS/PES in Africa, Asia, and Latin America, the reader is referred to Ferraro (2007), Huang and Upadhyaya (2007), and Southgate and Wunder (2007), respectively.

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USAID PES SOURCEBOOK APPENDIX

REGIONAL SYNTHESIS PAPERS, PES KNOWLEDGEBASE

OCTOBER 2007

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Regional Review of Payments for Watershed Services: Sub-Saharan Africa

Author:

Paul J. Ferraro

Prepared by:

Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program (SANREM CRSP)

Office of International Research, Education, and Development (OIRED), Virginia Tech

E-mail: oired@vt.edu
On the Web: www.oired.vt.edu

Submitted by Paul J. Ferraro, Department of Economics, Andrew Young School of Policy Studies, Georgia State University, P.O. Box 3992, Atlanta, GA 30302-3992

Submitted to SANREM CRSP, Virginia Polytechnic Institute and State University, Agreement No. EPA-A-00-06-00004-00, Global Assessment of Best Practices for Ecosystem Services Programs

Regional Review of Payments for Watershed Services: Sub-Saharan Africa

1. Introduction

Although there has been global experimentation with Payments for Watershed Service (PWS) schemes for almost a decade, only a couple of schemes exist in Africa.[1] The two African PWS programs that are currently making payments are both located in South Africa. As described below, these two programs have characteristics that are unusual when compared to PWS schemes in Latin America and Asia: they are essentially public works programs oriented towards securing hydrologic services. Given that the most common definitions of Payments for Environmental Services (PES) in the literature do not include such public works programs (e.g., Wunder, 2007; Ferraro, 2001), one could reasonably argue that there are **no** PWS schemes currently operating in Africa.

To define a PES, this review adapts Wunder's (2007) definition of a PES with two extensions.[2] A PES is a *voluntary* transaction in which an environmental service *buyer*, who does *not control* the environmental factors of production, pays an environmental service *provider*, who *controls* the environmental factors of production, for a *well-defined* environmental service using a cash or in-kind *payment that varies conditional* on the quantity and quality of the environmental service provided. Of course, there may be more than one buyer or seller involved in the transaction. Furthermore, the service itself may be costly to observe and thus the payment may be tied to observable performance that is correlated with the quality and quantity of the desired service (e.g., paying landowners to create riparian buffers that reduce runoff into nearby surface waters).[3]

In addition to the two programs in South Africa, there are at least eight other initiatives in formal planning phases in South Africa, Tanzania, and Kenya. Presentations at recent workshops (e.g., East and Southern Africa Katoomba Group, 2006) suggest that other initiatives are being considered by field practitioners and government agencies, but have not yet entered a formal planning phase.

Given the paucity of on-the-ground PWS initiatives, one cannot write about an "African PWS model" or "regional PWS trends in Africa." Thus this review has two objectives: (1) briefly characterize the South African initiatives and the proposed initiatives in other nations; and (2) describe the factors that likely cause Africa to have fewer PWS schemes than Latin America and other regions, where there are tens of such initiatives. The latter exercise is intended to help natural resource management and development practitioners think about the field characteristics under which PWS programs can succeed.

2. Payments for Environmental Services in Africa

For all types of environmental services, Africa lags Latin America and Asia in the development of Payments for Environmental Services (PES) schemes. For example, in the global carbon offset market for 2003 and 2004, Latin America and Asia accounted for more than three-quarters of the emissions

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[1] Because North Africa is often lumped cultural and biophysically with the Middle East, this review focuses on Sub-Saharan Africa. North Africa has no documented PWS schemes to date.

[2] The extensions are: (1) the supplier controls the factors of production; and (2) the payment varies with the level of environmental performance. The first extension implies, for example, that the wages or fees a farmer pays to laborers to construct a riparian vegetative strip on the farmer's land are not considered payments for environmental services. The second extension implies that offering someone a school or land title in exchange for a promise to provide environmental services is not a PES *unless* the amount of school or land title can be varied with performance (e.g., part of the school is destroyed or some of the rights inherent in the title are rescinded if the quality or quantity of services is lower than promised).

[3] Much like a private firm's manager, whose exact contributions to short-run and long-run profits are not easily observed, may receive compensation based on observable actions or indicators that owners believe are correlated with these profits.

reduction projects. Africa accounted for only three percent (Lecocq and Capoor, 2005).[4] Relative to other areas of the world, Africa also had fewer projects under preparation (Lecocq and Capoor, 2005).

The Katoomba Group commissioned PES inventories for Uganda (Ruhweza and Masiga, 2006), Kenya (Mutunga and Mwangi, 2006), Tanzania (Scurrah-Ehrhart 2006) and South Africa (King, Damon and Forsyth, 2005).[5] These inventories list eighteen biodiversity projects (of which two are making payments, in cash or in kind), seventeen carbon projects (of which five are making payments), and ten water projects (of which two are making payments). Jindal (2006) lists another thirteen nations with carbon sequestration projects, but none of them have more than one project (Kenya, Tanzania and Uganda together have seven projects). A couple other nations have biodiversity payment initiatives (Madagascar, Guinea).[6] However, no other payments for water services initiatives were identified. Bond (2006a) reports that PWS schemes were proposed in Zimbabwe and Malawi, but later abandoned. Examples of non-watershed services PES and PES-like activities in Africa are shown in Table 1.

The inventories' definition of what a "payment for biodiversity" project comprises in Africa (as well as the definition used in many other documents and presentations on PES in Africa) includes community-based natural resource management initiatives, ecotourism market participation (e.g., as guides or other tourist service providers), agricultural technology transfer projects, and projects that reward communities with limited access to protected areas.[7] A minority of the listed projects are conditional (performance-based). The Kenyan inventory lists ten PES projects (one water, one carbon and eight biodiversity) but has a disclaimer at the top which states, "The projects show elements of PES but may not necessarily exhibit explicit characteristics of the buyer-seller model." The Ugandan inventory includes, as a payment initiative for water services, the Uganda Breweries Limited wetlands program, in which the company has installed technology to reduce its pollution of the wetlands and has funded the government's public education efforts about wetlands.

A recent workshop aimed at "Catalyzing Payments for Ecosystem Services in Africa" further illustrates the paucity of initiatives (East and Southern Africa Katoomba Group, 2006). Of the eight African case studies presented from four nations, only one is about an on-going PES project; five are about the "potential for PES" in three nations, one is about implications of another initiative for thinking about PES, and one calls itself a PES, but the actual initiative is no different from a typical development project.[8]

Most African PES initiatives are funded through overseas development assistance, international conservation organizations, and increasingly, governmental agencies. There is currently little private sector involvement. A common refrain at PES meetings is that somehow conservation and development practitioners must "engage the private sector," which currently is unaware of the substantial purported gains from trade in environmental service contract schemes. Whether private sector involvement in PWS in Africa is likely or not is explored in section 4. In the next section, existing and planned PWS initiatives are examined more closely.

3. Payments for Water Services (PWS) in Africa

Below, two on-going payment programs in South Africa, as well as four other initiatives in South Africa and two in East Africa that are in the planning phases, are briefly described. The latter six proposed projects may or may not describe the future of PWS in Africa. Bond (2006a) found that of sixteen PWS proposals made globally in 2002, nine were abandoned by 2006, three were still proposals,

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4 In sub-Saharan Africa, only Uganda and South Africa had any large-scale transactions, and only a half dozen other Sub-Saharan nations were preparing projects as of April 2005.

5 Inventories are pending for Malawi and Madagascar.

6 See http://epp.gsu.edu/pferraro/special/ci/index.html.

7 Offering limited access is more like a cost-sharing program than a payment for the provision of environmental services.

8 Villagers were offered a mix of suasion, coercion and token compensation to re-vegetate river banks.

and the other four were in progress ("in progress," however, does not imply payments are being made yet).

3.1. Working for Water (WfW) Program, South Africa[9]

Launched in 1995, the Working for Water (WfW) program is a public works initiative that employs low-skilled, unemployed laborers and "historically disadvantaged individuals" (rural women, youth and the disabled). The contracted laborers remove invasive plant species that are established in about 10% of South Africa's total land area (about 10 million hectares). Over the last two decades, South African scientists have developed a strong scientific foundation that documents the effects of invasive plants on the South African environment and the most effective methods for controlling them. Invasive plants are estimated to use 7% of all water resources, as well as intensifying floods and fires, and threatening native biodiversity.

Working for Water was created with the intention of contributing toward the newly elected (1994) democratic government's goals of alleviating poverty, creating jobs, empowering the poor economically, and rectifying inequities created from decades of apartheid rule. Although it does little environmental targeting, it engages in strict social targeting. The WfW system encourages small-business entrepreneurs (particularly less experienced ones) to bid on WfW contracts for land management units where invasive species removal has been identified as important to increase water flows. Part of the WfW's mission is to encourage small business development as a form of social empowerment in poor communities.

WfW also has elaborate, affirmative action hiring protocols to ensure that the independent contractors focus on employing low-skilled, unemployed citizens, with a particular emphasis on women, youth, and the disabled (including HIV-infected individuals). Wages are set by WfW, and contractors are instructed that they must hire only the formerly unemployed and achieve hiring targets for women, youth and the disabled. Because of its emphasis on economic empowerment and working with largely unskilled labor in poor communities, WfW has a substantial training program that runs the gamut from work-related skills (e.g., machine operation) to general life skills (e.g., health education). The number of days of training an employee receives is a function of the number of days they work each month.

Most of WfW's activities are on public lands. For private land where the owner has not paid for WfW services, preference is given to emerging farmers (full funding) and land that is deemed a priority with regard to the "holistic clearing strategy" of WfW (80% funding for first two clearings, 60% for third). Private land that is not deemed a priority may be given incentives in the form of expertise, herbicides or a maximum of 50% funding.

WfW's annual budget is currently a little more than 500 million Rand (over US $70 million). Most of the budget (~80%) comes from general tax revenues from the central government through its Poverty Relief Fund. The next largest contribution (nearly the rest of the budget) comes from the Department of Water Affairs and Forestry's general budget, about which a little more than half comes from "water resource management fees" charged in thirteen of the nations' nineteen Water Management Areas. In order of decreasing importance, foreign donors, municipalities, and the private sector comprise the remaining small fraction of the WfW budget.

Since its inception, WfW has cleared more than one million hectares of invasive plants. In recent years, the program has been clearing almost 200,000 hectares each year while employing 25,000 to 32,000 people annually. While these figures are impressive, South Africa's invasive species problem is enormous and the WfW has not reversed the spread of invasive plants across South Africa. Supporters contend, however, the spread would have been worse in the absence of the WfW. Although no careful empirical evaluations have tested this hypothesis, one might reasonably assume that much of the plants removed would not have been removed without the program. Thus by using hydrologic models that

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[9] Sources: Documents, including annual reports, from http://www.dwaf.gov.za/*WfW*/. Conversations with Christo Marais of the *WfW*. Information on municipal and private sector involvement from Turpie (2004), Turpie and Blignaut (2005), and participant comments at the East and Southern Africa Katoomba Group meeting (2006).

relate area and species cleared to water flow, an estimate of the additional water flow provided by the program can be estimated. One study reports additional water flows as a result of the WfW equal to 250 million m^3 annually (Turpie and Blignaut 2005).

The WfW program is essentially a government paying to secure services on government-controlled lands. Thus many PWS proponents would not consider it to be a PWS initiative. Rather than enter this debate, it can be emphasized that the infrastructure established by the WfW can permit activities that are more consistent with the use of the term "PWS" in the literature. The Department of Water Affairs and Forestry has been trying to encourage voluntary payments from private and municipal actors with catchments infested with invasive plants. A few municipalities, state-owned utilities, and private companies have paid into the WfW program in order to have WfW teams clear invasive species from the catchments from which the payers obtain their water supplies. Rather than incur the costs of setting up their own systems for invasive species removal, these local and private actors took advantage of the WfW institutional infrastructure. Such transactions are closer to what PWS proponents describe as "true" PWS programs. Note also that the WfW structure also offers opportunities for foreign donors, like the Global Environment Facility, to invest in removing invasive species that threaten the habitats of globally important biodiversity.

3.2. Working for Wetlands (WfWet) program, South Africa[10]

Working for Wetlands (WfWet) was informally started in 2000 when the Working for Water (WfW) program rehabilitated some wetlands. WfWet became a separate program in 2001 and, in 2003, its management was taken over by the South African National Biodiversity Institute (SANBI) on behalf of the departments of Environmental Affairs and Tourism, Water Affairs and Forestry, and Agriculture. Management by SANBI, under the Department of Environmental Affairs and Tourism, underscores the greater environmental emphasis of WfWet compared with WfW. Nevertheless, the model through which WfWet achieves its environmental goals is the same as WfW: a public works program that focuses on employment creation and training for the unemployed and historically disadvantaged individuals.

Wetland rehabilitation requires more than simply clearing invasive plant species. It requires highly skilled planning and engineering labor, as well as more careful environmental targeting. Thus, WfWet has a less onerous hiring protocol for contractors than WfW. The most important aspects of the contractor bid are price and technical merit. Only 10 out of 100 points allocated to a contract in the bidding system are designated for details related to participation by disenfranchised individuals, women and disabled people. For the labor intensive portions of the projects similar criteria to WfW are used to ensure the hiring of the unemployed with the same percentage targets for women, youth and the disabled. Due to the amount of engineering involved with some of the projects, equipment operators can receive higher pay than laborers. Moreover, unlike the WfW program, WfWet prioritizes the wetlands slated for rehabilitation based on biophysical characteristics with less regard paid to the land ownership. WfWet first identifies its priority catchments, and then narrows the choice by site and landowner criteria (current use, perceived value, etc.).

Like WfW, the vast majority of WfWet's budget (67 million Rand in 2006) comes from the Poverty Relief Fund. Some other funds come from international donors/conservation groups. For the 2006 fiscal year, WfWet is implementing forty-two projects covering all provinces, employing almost seventeen hundred people from the target population of poor and historically disadvantaged, and rehabilitating 157,000 square miles of degraded wetlands. Funding for long-term maintenance and protection is a concern, but there are plans for follow-up support and regulation enforcement to maintain the benefits of rehabilitated wetlands over time.

3.3 Proposed Projects in South Africa[11]

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[10] Sources: http://www.sanbi.org/research/wetlandprog.htm

[11] Sources are cited in text.

King, Damon and Forsyth (2005) list five other South African PWS initiatives that are in the planning stages: (1) Ga-Selati River, Olifants Catchment project; (2) Maloti-Drakensberg Transfrontier project; and (3) three initiatives in the Sabie River, Sabie-Sand catchment. These five proposed initiatives are structured more like traditional PWS initiatives than the two South African initiatives described above.

In the Ga-Selati River catchment, proponents of the initiative envision downstream users paying upstream land managers to change land use practices to increase flows and reduce sediment. A mine in this catchment already leases 500 hectares from an upstream rural community to protect the riparian zone of their water source (Turpie and Blignaut, 2005). Among the "payments" to upstream farmers being considered by the project are training in the best agricultural practices for saving water by more sophisticated downstream commercial farmers, transfers of old piping from mines that upstream farmers can use to line earthen irrigation canals, and wages to laborers who remove invasive plants. The degree to which these payments are conditional is unclear (other than, of course, the wage for plant removal).
The Maloti-Drakensberg Transfrontier project (Diederichs and Mander, 2004), which spans parts of Lesotho and South Africa, is a larger project that includes a PWS component. The project falls in the catchment that supplies approximately 25% of South Africa's water. The main identified threats are invasive plants in and along the rivers and land degradation from burning and grazing.

Within the Sabie-Sand catchment, research is underway to examine how payments for catchment protection can be incorporated into the management plan of a newly created Catchment Management Association (CMA). South Africa's National Water Act (Act No.36 of 1998) called for the creation of CMAs as a way to decentralize catchment management. The Sabie River catchment was chosen as one of the first locations for creating a CMA. Researchers are exploring the potential for payments from commercial game farmers, urban water users, and a local bird club that wants to pay communities to protect riparian habitat and stream flow needed by birds.

3.4 Proposed Project: East Arc Mountains, Tanzania[12]

The Uluguru Mountain watershed is home to forty-eight villages and an estimated population of 90,000 people. Forests in the watershed are believed to be important for downstream hydrologic services that benefit Dar es Salaam, the coast, and the Morogoro region. Deforestation is threatening these forests. A scoping project, run by WWF, CARE, and IIED and entitled "Equitable Payments for Watershed Services" is exploring the potential for PWS in the watershed (as well as payments for other services like carbon sequestration).[13]

This scoping project is documenting the hydrologic relationships and the potential buyers and sellers of watershed services. Preliminary evidence suggests that the watershed's forests can no longer hold enough water during the wet season, which leads to water shortages downstream. The goal of the project is to "help mountain communities stabilize and improve the productivity of their farms as well as prevent further forest loss." Downstream water authorities and private sector corporations are the intended buyers of the hydrologic services, but the scientific case is being developed before the buyers will be approached for participation. Similar scoping work is also being conducted in another nearby watershed (South Nguru).

Tanzania is also home to another proposed project that has a PWS component: the IUCN-WANI Pangani River Basin Demonstration Site Project. Although the project is not primarily a PES project, it proposes to initiate feasibility studies with a particular eye toward establishing the willingness on the part of users to pay for water services.

3.5 Proposed Project: Sasumua Water Treatment Plant, Kenya[14]

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[12] Sources: WWF (2006) and WWF (n.d.).
[13] ICRAF has recently become involved in the same initiative through its PRESA project (Pro-poor Rewards for Environmental Services in Africa; Swallow and Yatich, 2007).
[14] Sources: World Agroforestry Centre (2006).

The Sasumua Water Treatment Plant treats water for the Nairobi Water Company, which provides water services to the Kenyan capital. The plant draws water from a few small watersheds in the Aberdares Mountains. The treatment plant is affected by two water quality problems: sedimentation, which clogs the intakes, and water contamination from nutrients and agrichemicals. The plant expends funds each year to clear its intakes of silt ($50,000/year) and treat the water prior to delivering it to consumers ($100,000/year). The sedimentation and pollution originate mainly from runoff from upstream land users and from effluent from towns.

The project is exploring the potential for the plant to pay upstream land users to alter their land use in ways that reduce sedimentation and agricultural pollution. The costs of engineering approaches to removing silt and pollution serve as the benchmarks from which a PWS scheme will be evaluated. Project proponents note that making the case for payments is easier when the damage is already visible, as it is at the Sasumua plant. However, the same proponents note that reversing the damage is more costly than preventing it from arising in the first place. The necessary payments are anticipated to be needed on an ongoing basis and would be paid either out of the existing treatment plant budget (from cost savings in avoided dredging and treatment costs) or through additional "conservation fees" to water users. The institutional structure for making the payments must be worked out and could be difficult given overlapping jurisdictions over different components of the water system (Nairobi Water Company, Athi River Water Services Board,[15] Water Resource Management Authority, and the Nairobi City Council). The project is connected to a larger agricultural development project called the Kenya Agricultural Productivity and Sustainable Land Management (KAPSLM) project.

Kenya is also home to a newly proposed PWS project in watersheds associated with Mt. Kenya and the Tana River. The project, a collaboration of the GreenWater Credits project and the International Fund for Agricultural Development, is part of a larger program entitled "Pro-poor Rewards for Environmental Services in Africa." One other Kenyan program that sometimes appears in lists of African PWS schemes is the Western Kenya Integrated Ecosystem Management Project. The objective of this project is to reduce soil erosion and associated pollutant transport into Lake Victoria, which is a critical fresh water resource (GEF, 2005). A key project component is to encourage adoption of sustainable land management (SLM) practices that sequester carbon and pay local communities for carbon credits. The SLM initiative is believed to lead to a co-benefit of reduced sediment, nutrient, and chemical runoff into surface waters. This project shows that, in some cases, payments for non-water ecosystem services may generate water-related services.

4. Why so Few PWS Schemes in Africa?

Africa is the most capital-poor, inhabited continent on earth and thus, not surprisingly, most of its rural populations depend upon ecosystem services for their livelihoods. With regard to water, more than 300 million of the estimated 800 million who live on the African continent live in water-scarce environments. Sub-Saharan Africa includes eleven of the sixteen nations of the world having less than 1000 m^3/head/year of water, a situation described as `absolute water scarcity' where food shortages are a constant threat and water shortage can only increase (FAO 1995). Forecasts (Johns Hopkins, 1998) estimated that by 2025, about one in two Africans will be living in countries that are confronted with water stress or water scarcity (stress implies less than 1,500 m^3/capita/year). Pollution from agricultural runoff, industrial discharges, and sewage exacerbates water scarcity.

If water is so scarce and increasing its supply so important, why are there so few PWS programs in Africa? Payments for watershed services proponents frequently cite a common list of obstacles to the development of PES schemes: lack of technical and market information, limited institutional experience, inadequate legal framework, limited successful business models, suspicion of markets for public goods

[15] http://www.awsboard.com/faqs.asp

and equity concerns. Based on this review of PWS and the African continent, these characteristics are also likely barriers to African PWS development (as in other continents), but there seem to be more fundamental barriers, which are described in this section.

To begin to answer the question of why there are so few PWS initiatives in Africa, it is instructive to rephrase the question: "Why are there a large and growing number of PWS initiatives in Latin America and so few in Africa?" The contrast between the two regions is instructive for understanding constraints to using PWS in Africa and elsewhere.

4.1 Is there substantially less demand for water services in Africa?

A recent global review of all types of PES concluded (Waage 2006: 3), "[t]he barriers first and foremost stem from finding willing and able buyers" and "[t]he reasons for this unrealized demand range from a lack of awareness through a sense that PES is too nascent and thus risky." It has been established that water scarcity and, to a lesser extent, water quality are important issues in Africa. Thus perhaps it is true that the economics favor PWS, but lack of information and familiarity with the PWS mechanism constrains demand.

However, even if the values for watershed services were clearer and the hydrologic relationships between land uses and hydrologic services were more transparent, securing financing for payments requires two things: (1) institutions capable of excluding nonpayers (free-riders); and (2) water service consumers with the ability to pay. Below, the potential institutional sources of payments for watershed services in Latin America and Africa, and the ability of Latin Americans and Africans to pay, are considered.

4.1.1 Institutional Sources of Payments

In general, payments for watershed services come from five sources: hydroelectric power suppliers, large industrial users, municipal water suppliers, irrigation water users and general tax revenues. Below, these potential sources in Latin America and Africa are contrasted. It is worth mentioning that in most PWS cases in the world, existing revenue streams are being used to make the conservation payments. Only in a few cases have rates paid by end-users been raised. Thus the financial health of institutions is an important prerequisite for PWS schemes, a quality for which African institutions are not well known.

Hydroelectric Power

Africa generates little electricity in comparison to other regions of the world (almost half is generated by South Africa alone) and less than 20% of the generation comes from hydroelectric sources (Lokolo, 2004; United Nations, 2004). In contrast, almost 70% of Latin America's substantially greater electricity production comes from hydroelectric sources (United Nations, 2004). Unlike Latin America and parts of Asia, Africa does not have high hydroelectric potential because so much of the continent is subject to a semi-arid climate with periodic droughts. Sub-Saharan Africa has hydroelectric potential of 710 Terawatt hours (TWh), of which 6% was developed in 1990s. Latin America, in contrast, had 3280 TWh of potential, of which 12% was developed (i.e., almost ten times the amount is currently produced). The hydroelectric capability of Africa is mainly located in its most institutionally weak nations: Democratic Republic of Congo, Cameroon, Ethiopia and Madagascar (Lokolo, 2004). Moreover, in terms of potential numbers of payers, Latin America and the Caribbean nations have the highest electricity coverage (84%) of any region in the developing world, whereas Africa has the lowest (around 10%).

Municipal Water Suppliers

As with hydroelectric power, Africa also has fewer formal water delivery systems and fewer citizens connected to them in comparison to Latin America (UN-HABITAT, n.d.). Thus there are fewer people that can easily be charged for domestic water. A study of water supply and independent providers in ten African capital cities (including Nairobi) estimates that in the majority of these cities, only one-

quarter to one-half of the households have access to piped supplies, with the rest of the households relying on independent providers or traditional sources (Collignon and Vézina 2000). In Kenya, there are 201 urban centers in the country, but only 109 have piped water systems and all are government-run (World Bank, 2004a). Within Nairobi, only 42% of households have water connections serviced by the Nairobi Water and Sewerage Company (Athi River Water Services Board).[16] Almost all other households obtain water from kiosks, vendors and illegal connections. Of the existing customers, more than 40% do not receive 24-hour service, 30% receive water about once every two days, and 10% receive water only once a week. Asking such customers to pay an additional charge for hydrologic services might be difficult even if they were not as poor.

Rural households have much lower connection rates (Donkor, 2006). For example, in the Sudan in 1995, urban housing units with piped water constituted 62%, whereas in the rural areas, the coverage was only 18%. In Malawi in 1990, the figure for urban areas was 75% and for rural areas 16%. Most Latin American nations have higher rates of urban access to piped water and, more importantly, much higher rates of urbanization. About three-quarters of the Latin American population is urban (similar to the United States). In contrast, only 35% of the African population lives in urban areas, although this figure is projected to double by 2030 (UNDP, 2002).

Furthermore, investing in watershed management is not an obvious priority for African municipal water supply systems. Urban water systems are caught in a cycle of declining investment, quality of service, and financial returns, characterized by (a) low coverage and unreliable service, (b) high levels of unaccounted-for water and unpaid bills, (c) poor financial management, (d) revenues insufficient to cover operations and maintenance costs, and (e) inadequate commercial management (World Bank, 2001; 2004b). For example, studies in Dar es Salaam (Cudjoe and Okonski) and Nairobi (Gulyani et al., 2005:4) found that about half of the water that entered the system was "unaccounted-for" through leaks, theft, and unbilled or uncollected revenues. In Mombasa, Kenya, all of the 57,500 connections are metered, but about one-third of these meters do not work (unaccounted-for water was estimated at 40%). Billing and collection efficiencies for Nairobi and Mombassa, Kenya were between 60 and 70%, with accounts receivable representing more than two years service in Nairobi (Gulyani et al., 2005).

Scurrah-Ehrhart (2006) recounts an interview with a water authority in Tanzania on the topic of PWS. Although results from studies conducted in the water authority's catchments implied water users were willing to pay for water services, the water authority disputed such results. It claimed that it was difficult simply to collect the current low user fees from their customers. A potentially higher fee associated with a PWS scheme would be even more difficult.

Irrigation Associations

Payments for watershed services schemes involving the irrigated agricultural sector are not common on any continent. In Africa, agriculture represents the bulk of water withdrawal. The FAO (2005) reports that for the African continent as a whole, 86 % of water withdrawals are directed towards agriculture and this percentage is even higher in the arid and semi-arid regions. In Latin America, however, water use by agricultural sector is also high at 73% (AQUASTAT, 2007).

Latin America has seen a much greater degree of irrigation network privatization and decentralization to irrigation user associations than Africa (AQUASTAT, 2007; FAO 2005). Although the difference between the two regions will likely decline over time (e.g., all new irrigation schemes in Kenya between 1992 and 2003 were private), the absence of irrigation-driven PWS schemes in Latin America where conditions are more conducive suggest that African irrigation-driven PWS schemes are unlikely in the near term.

Industrial Water Users

Industrial water users are self-supplied industries not connected to a distribution network. No specific data on differences between Latin American and African industrial users were identified.

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[16] Summary available at http://www.awsboard.com/faqs.asp

Industrialization is certainly much lower in Africa than in Latin America, and thus were this sector to be a potentially important source of funds for PWS schemes, one would expect to see more industry-driven PWS programs in Latin America. These were not found. However, in Africa, the frequency of mining activities in water scarce environments may counterbalance Latin America's advantage in this regard.

General Tax Revenues

The final institutional source of PWS financing is general tax revenues. With regard to this potential source of funds, Africa has much less capacity for PWS financing than Latin America. Africa has smaller government budgets (just over half), larger populations (almost double), higher levels of poverty (more than three times higher), and higher rates of government expenditures expressed as a percentage of GDP (despite the African GDP being much lower). All of these observations imply that Africa has much less capacity than Latin America for drawing on tax revenues to fund PWS programs.[17]

4.1.2 Ability to Pay

Getting African water users to pay for hydrologic services is made difficult by high levels of poverty. Thirty-four of the forty-nine least developed countries are African (FAO, 2005). In 1993, the World Bank-estimated poverty rates for Africa and Latin America were 50% and 15%, respectively (World Bank, 2000). However, poverty also makes the required payments for PWS lower in Africa than in Latin America (i.e., African suppliers' opportunity costs are lower). Thus there is no clear relationship between poverty and the ability of beneficiaries to pay for water services.

However, the high-profile development goal to increase Africans' access to safe drinking water makes it politically more difficult to insist that water users pay a higher fee. The weighted average of population with access to safe drinking water for fifty-two African countries covering the period from 1992 to 1994 was 46%, while in Latin America the rate was 80% (Gleick, 1998). Even in South Africa, where the percentage of the population with access to safe water is relatively high by African standards, restricting water access to non-payers is controversial. Opponents to pricing water often point to a serious outbreak of cholera in 2000 that occurred when water prices increased in Kwazulu Natal and many poor residents sought other, less safe sources of water as substitutes. Because water is a larger portion of their budget, poor residents likely have a much higher price elasticity of demand for water than non-poor residents.[18]

On top of these constraints, one must also recognize that Africans already use much less water per capita than in other areas of the world and they pay more per unit. For example, in Kenya, Gulyani et al. (2005) found that mean per capita daily water use is thirty-three liters for the poor and forty-four liters for the nonpoor, and both groups pay an average of about US$3.50/m^3 (almost six times what a consumer pays in Atlanta, Georgia, USA).

4.2 Transaction Costs

When discussing barriers to PES development in Africa, many authors identify high transaction costs as important barriers (Muramira, 2005; Grieg-Gran et al., 2006; Ochieng et al., 2007). Although transaction costs are frequently identified as a problem in all nations (Bellagio Group, 2007), there are reasons to believe that PWS schemes in Africa may be particularly affected by such costs.

4.2.1 Land Distribution

Although average population densities per square kilometer in the late 1990s are similar in Latin America and Africa (about 25 people/km^2; McDevitt, 1999), 73% of Latin Americans (including

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[17] Sources: Government consumption and expenditures (UN 2004b, Fan and Rao 2003); Population (www.overpopulation.org/); and Poverty Rates (World Bank 2000).

[18] If there are wealthier, large consumers of water in a market, a tiered pricing system, which charges low rates for use below some threshold level and rapidly increasing rates above the threshold, may be one way to raise revenues without placing a heavy burden on the poor.

Caribbean) lived in urban areas in 1995, compared to only 35% of Africans (UN-HABITAT, n.d.). Land ownership is much more concentrated in Latin America than in Africa (Lastarria-Cornhiel et al., 1999). Thus in Latin America, PWS schemes are more likely to contract with a smaller number of large landowners, whereas in Africa, they must contract with many small land users/owners. Note that the less concentrated distribution of land in Africa also implies that should a PWS be feasible, it is more likely to be pro-poor than in Latin America.

4.2.2 Transboundary Watersheds

Africa has sixty transboundary river basins which together cover more than 60% of the continent's total area. Thus water management in Africa is often transboundary in nature, but the same is true in South America (Wolf et al. 1999). Thus it is not clear that transboundary water management is more problematic in Africa. However, in Africa, regardless of whether watersheds cross national boundaries, watersheds are more likely to have greater cultural heterogeneity among upstream and downstream users than in Latin America. For example, upstream and downstream users in Africa are more likely to speak different languages. Such heterogeneity may increase the costs of creating mutual understanding, trust, and other forms of social capital, which lower the transaction costs of contracting.

4.2.3 Making and Enforcing Contracts

A PWS scheme is a contracting scheme and thus the factors that are typically identified as curtailing business activity apply to PWS development: e.g., regulatory environment, rates of literacy, judicial system, availability of information, trust, and corruption. Although most nations in Latin America are not paragons of business-friendly societies, they do tend to have higher indicator scores than Africa. For example, of the sixty-four most corrupt nations in the world (Transparency International, 2006), twenty-five are from Sub-Saharan Africa (out of forty-eight African nations). Only eight are from Latin America (out of twenty-one nations).

A more directly relevant indicator of transaction costs is the measure of the cost of enforcing contracts in a nation. The World Bank measures this cost as court fees and attorney fees expressed as a percentage of the debt value. In Latin America and the Caribbean, the value is 23%, while in Sub-Saharan Africa, the value is almost double at 42%.[19]

Furthermore, in Africa, many of the water suppliers, hydroelectric power sources and other potential water buyers are controlled by the state. Thus, governance is an important issue. Scurrah-Ehrhart (2006) relates the story of the Tanzania Electricity Supply Company Ltd. (TANESCO). TANESCO currently pays the Ministry of Water and Livestock Development an annual 'user fee," of which a proportion is given to Water Basin Authorities to carry out catchment management activities. In practice, however, the Water Basin Authorities do not carry out these activities.

4.3 Land Tenure Security

When discussing barriers to PES development in Africa, other authors have identified the African land tenure situation as important (e.g., Muramira, 2005; Mwangi and Mutunga, 2005; Ochieng et al., 2007).[20] Although tenure systems are diverse on every continent, a review of global tenure trends (Lastarria-Cornhiel et al., 1999) argues that Latin American tenure systems have historically been based on private ownership, whereas in Africa most land is held under customary tenure that provides access to land to all recognized members of the community. Thus, PWS schemes in Africa will frequently have to address multiple sources of formal and informal authority over a given tract of land. Indeed, in South Africa, the program in the Ga-Selati River catchment had made a lot of progress in the design phase, but stalled because of conflicting land claims and ongoing reform over water allocations (N. King, per. comm. 2007).

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[19] http://www.doingbusiness.org/ExploreTopics/EnforcingContracts/

[20] One could argue that issues related to land tenure belong under "transaction costs," but because many authors in the PES literature seem to treat tenure issues as different from transaction costs, they are separated here.

Customary tenure systems in Africa generally do not permit land sales, particularly to persons outside the community, and even leasing can be complicated by tenure insecurity (i.e., someone leasing land could gain rights over it), which makes rental rates higher than they normally would be (Lastarria-Cornhiel et al., 1999). Compared to Latin America watersheds, African watersheds are much more likely to have many people with usufruct land rights. Thus PWS contracts, which typically contract for actions that curtail access and use to land, may be more difficult in Africa than in Latin America.

Given the likelihood of multiple property claims on a piece of land, payments in Africa are more likely to be at the community level than the household level, which complicates project design. Although there are examples of community-based revenue sharing schemes (e.g., CAMPFIRE in Zimbabwe) and community-based PES (e.g., Nhambita Community Carbon Project in Mozambique), not all African nations recognize customary tenure or "communities" (villages, village councils, etc.) as autonomous legal personalities, particularly when the land in question is "wild" forests or wetlands. Even when such tenure systems and local institutions are recognized, designing a community-based contract that induces the required individual behaviors is much more difficult than in situations with single owners with secure property rights.

4.4 Enabling Legislation & Policies

Reports on PES related to Africa (Waage et al., 2005; Muramira, 2005; Mwangi and Mutunga, 2005; Scurrah-Ehrhart, 2006) argue that a key constraint is the lack of "enabling legal, regulatory and administration elements." Nations in which there is some PES activity (Uganda, Kenya and S. Africa) have some enabling legislation (Ruhweza and Muhumure, 2005). However, no inventories have been completed in nations without PES, and thus one cannot clearly observe a causal relationship between the enabling legislation and PES development.

Other nations, such as Costa Rica, have demonstrated that the policy environment can catalyze PES initiatives. Other nations, such as the United States (cities of New York City, Boston, and Syracuse with respect to their watershed management activities) have also demonstrated that the regulatory environment can directly stimulate PWS contracting. Local government authorities may be reticent to engage in PWS schemes, but through suasion and regulatory threats, that reticence can be reduced. Moreover, it has been amply demonstrated that enabling legislation is important for carbon markets.

In some cases, there may be legislation that explicitly forbids a PWS-related activity. For example, South Africa's National Water Act prohibits some activities for which someone might want to make a payment, such as removal of vegetation from a riparian zone or stopping agriculture in a riparian zone (King et al., 2005). In other cases, authority over water and land use may be too decentralized to allow for effective coordination across a catchment (e.g., if water user's associations are defined at the sub-catchment level).

However, no clear case for the lack of enabling legislation being an important barrier to PWS development has been made. In many African nations, there is legislation for channeling "user fees" (called "abstraction fees") to watershed management.[21] There may be weaknesses in the systems (Scurrah-Ehrhart, 2006) and an unwillingness to charge such fees, but the authority to do so exists in many African nations. Indeed, the summary of the East African and South African PES inventories (Katoomba Group, 2006) identifies the lack of supporting legislation as a barrier, but notes that "in most countries, policies establishing the right to buy and sell ecosystem stewardship services have not been essential for pilot activity in PES."

4.5 Supporting Institutions

A report summarizing PES inventories for East Africa and South Africa (Katoomba Group, 2006) claims that, "Most countries cited lack of necessary institutions—such as certification bodies; financial intermediaries; national registries for ecosystem services; and so on— across the value chain from seller

[21] See, for example, the country water law documents at http://www.silsoe.cranfield.ac.uk/iwe/expertise/waterlaw.htm

to buyer that increase current PES transaction costs." However, it is not obvious that certification bodies, financial intermediaries and national registries for ecosystem services have been important in the development of PWS in Latin America. A much more likely institutional barrier to PWS development in Africa, in comparison to Latin America, is simply the unsophisticated state of most water management agencies in Africa and the absence of the will and means to charge water users for water quantity and quality improvements.

4.6 Hydrology

It is difficult to determine if there is a fundamental difference in the hydrologic regimes of Africa and Latin America that makes PWS schemes less likely in Africa. Average annual precipitation in Africa is estimated at about of 678 mm with wide variability (FAO, 2005), whereas average precipitation in South America and Central America is much higher with most of Central and South America receiving between 1,000 and 3,000 mm/year.[22] With less precipitation and surface and subsurface flows, interventions over similar land areas may have smaller impacts on downstream flows in Africa and PWS schemes may have to operate a larger scale to achieve comparable impacts. At large scales, however, measuring impacts from PWS programs may be difficult because of the larger set of confounders and the potentially longer time-lags in hydrologic response associated with low precipitation.

4.7 Awareness and Human Capacity

When discussing critical barriers to PES development in Africa, some authors identify a simple lack of awareness about the idea and the lack of capacity to design and implement a PES scheme (Muramira, 2005; Mwangi and Mutunga, 2005; Katoomba Group, 2006; Ochieng et al., 2006).[23] The concept of PWS schemes is relatively new and given the constraints on information transmission in Africa, one would expect PWS development in Africa to be moving more slowly than in Latin America.

In 2005, practitioners established an East and Southern African working group on PES to share information and conduct training for practitioners and policymakers. Development donors are also conducting PES training for Africans. Thus in the next five years, one should be able to test the hypothesis that lack of human capacity is a major bottleneck. If this lack of awareness and capacity is truly a constraint on PWS development, one should see a lot more PWS development.

However, if an absence of hydrologic knowledge is a key constraint, then one might not see more PWS development in the next five years. Participants at a 2005 African PES workshop concluded that the "[t]echnical capacity to identify and monitor links between resource management and provision of ecosystem services is weak in all countries."[24] A search of water-related articles from Water Resources Abstract for a dozen African and a dozen Latin American nations showed Latin American nations had about double the number of articles per nation. Even removing a few outliers (Mexico, Brazil, South Africa) left Latin American nations with almost 60% more articles. If articles are a good proxy for the state of knowledge, then Latin America has a much better level of understanding of the hydrologic relationships relevant to PWS schemes.

4.8 Insights from South Africa

Given the barriers to the development of PWS listed above, it should come as no surprise that the majority of African PWS activity is taking place in South Africa. Relative to the rest of Sub-Saharan Africa, South Africa has a better business climate, higher income levels, greater scientific capacity, better understanding of the nation's hydrology, greater institutional capacity, a stronger national water law that

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[22] http://www.r-hydronet.sr.unh.edu/

[23] See also summary of Workshop "Building Foundations for Pro-Poor Ecosystem Services in Africa." Eighth Public Meeting of the Katoomba Group 19-22 September, 2005, Uganda. http://www.katoombagroup.org/africa/uganda.htm

[24] "Building Foundations for Pro-Poor Ecosystem Services in Africa." Eighth Public Meeting of the Katoomba Group 19-22 September, 2005, Uganda. http://www.katoombagroup.org/africa/uganda.htm

makes provision for the use of economic instruments in water management (Act No 36 of 1998), and higher rates of access to safe water.

In its two operational PWS programs (section 3.1 and 3.2), South Africa has managed to address the imperative of assisting the poor and circumvent the problems that arise from complex tenure systems. They have done so by adopting a public works program approach that permits targeting of benefits to the disadvantaged and avoids contracting with land users (i.e., focuses on government lands). This approach also leads to broad national support for the programs. Moreover, the contracts in these programs are for activities for which compliance is relatively easy to monitor (removing invasive plant species on a plot of land, or rehabilitating a wetland).

Although general tax revenues fund the two current PWS schemes in South Africa, the infrastructure that has been developed lends itself to municipal and private sector involvement. From this perspective, the South African program has much in common with the Costa Rican Programa de Pagos de Servicios Ambientales, which is also a national-level program into which non-national government agents can pay to secure ecosystem services for their private benefit. Given that South Africa has better governance than much of Africa, it is unclear whether such an infrastructure could be built elsewhere in the near future. Trust that a government agency would deliver services commensurate with the level of payment requested is generally low in Africa.

5. Discussion and Conclusion

As noted in the Introduction, the paucity of on-the-ground PWS initiatives precludes a definitive discussion of an "African PWS model" or "regional PWS trends in Africa." Nevertheless, there are some common elements of existing and proposed African PWS initiatives.

First, and most importantly, poverty alleviation and equitable wealth distribution are key objectives in most African PWS projects (the exception is the Kenyan Sasumua initiative). Poverty issues are important components of Latin American PWS schemes, but the top priority of Latin American PWS schemes is the watershed services. In Africa, poverty alleviation and services are viewed as equally valued joint products of PWS schemes, or the provision of watershed services is merely viewed as a co-benefit of the poverty alleviation scheme (e.g., Working for Water Program). The implied social targeting that comes with a focus on poverty alleviation will likely increase the transaction costs and decrease the level of watershed services provided by PWS in Africa. Whether PWS can have a large impact on poverty remains to be seen. PWS proponents tend to not view PWS as an important poverty alleviation tool unless the program is a large-scale public works initiative like South Africa's Working for Water program (e.g., Bond, 2006b; Bellagio Group, 2007). The appeal of a PWS scheme that provides employment benefits may explain the African interest in the potential role of PES to restore degraded ecosystems (Ruhweza & Muhumure, 2005).

Second, as in most other nations, there are no programs that involve trading under a regulatory cap on the level of ecosystem services, nor trading schemes that are induced because of increasingly more stringent regulatory requirements. Third, the two existing programs in South Africa depend on general tax revenues for financing. The choice of such financing stems from a strong program emphasis on economic empowerment and poverty alleviation rather than ecosystem services, and from the political controversy surrounding raising water prices in a poor nation. The planned programs in Africa are hopeful for financing that comes from water users directly, but none have clearly secured such a funding source. South Africa's WfW program shows that the dichotomy that some PWS proponents make between "public payment schemes" and "self-organized private deals" is not a strict one: the government can maintain an institutional infrastructure through which individual beneficiaries of ecosystem services (e.g., private companies) can make their payments to service suppliers. Such a system currently operates in Costa Rica, where private beneficiaries can set up self-organized deals (e.g., Heredia water utility) or pay into the centralized national payment system (e.g., Energía Global hydroelectric company).

When PWS programs are government-funded, like the programs in South Africa, some observers claim they are less "sustainable" than self-organized deals between the beneficiaries and the sellers of the service. Such claims, however, implicitly assume that market transactions are somehow more sustainable than government programs funded by taxation and user fees. There is no evidence to support such a claim. If anything, large government programs that lead to large numbers of rent-seekers seeking to protect and expand the program may be more sustainable than market transactions.

For example, the Working for Water program in South Africa, with former president Nelson Mandela as its "patron in chief," is so popular that it is slated to continue until at least 2020 (WWF, 2006). According to a former South African Minister of Water (K. Asmal), the Ministry of Finance now sees the program as a positive contribution to economic, not just environmental, goals and thus also supports it (East and Southern Africa Katoomba Group, 2006). Rather than sustainability being a weakness of government-financed PWS, a more important problem is the difficulty that government-funded programs have in adapting to changing conditions and new information that call for a redistribution of their investments.

Another argument frequently made in the PES gray literature and presentations is that tax-financed PWS programs are inherently less cost-effective than private payment programs. However, given that most water and hydroelectricity suppliers in Africa are government-run or regulated private entities, there is no reason to believe they will be any more cost-effective. Even when the buyer is a private enterprise, the fact that many private enterprises engage in these deals for reasons of corporate social responsibility and reputation also suggests that they may be no more cost-effective than tax-financed initiatives. Indeed, the greater scrutiny of government programs may lead tax-financed PWS to be more cost-effective over time.

PWS schemes that connect water users directly to water suppliers, however, do have the advantage of generating new money for conservation. However, this additional money may not necessarily go to the area to which the water users are directing their payments. Other governmental or nongovernmental agencies may simply redirect their funds to other areas: in other words, the new money will be a substitute, rather than a complement locally (globally, it may indeed be a complement). Such substitution has been observed in Costa Rica (e.g., Heredia water supply company's PWS program, which receives no payments from the government's PES program (L. Gámez, per. comm., 2007).

In conclusion, for all of the reasons discussed in section 4, there will likely be fewer PWS schemes in Africa than elsewhere. However, these barriers to PWS development do not imply there are no opportunities for PWS. There are already a couple of large-scale initiatives and a number of incipient initiatives that may succeed in establishing PWS schemes. Further experimentation and information-sharing over the next five years should offer a clearer picture of the potential for PWS to achieve environmental and social objectives on the African continent.

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Table 1. PES projects in Africa

Country	Initiative	Organization	Status	Source
Cameroon	Cameroon timber concessions	Conservation International	Proposed	http://epp.gsu.edu/pferraro/special/ConcessionConceptDescription.pdf
Guyana	Guyana timber sales agreement	Conservation International	Ongoing	http://epp.gsu.edu/pferraro/special/ConcessionConceptDescription.pdf
Kenya				
Arabuko-Sokoke Forest	Arabuko-Sokoke Forest Management and Conservation Project	BirdLife International, Nature Kenya	Ongoing	http://www.birdlife.org/action/ground/arabuko/index.html
Amboseli	Wildlife conservation in Amboseli, Kenya	FAO	Ongoing	ftp://ftp.fao.org/es/esa/roa/pdf/roanews07.pdf
Kitengela region	Kitengela wildlife conservation lease program	The Wildlife Foundation	Ongoing	http://www.usaid.gov/ke/ke.naremgnt/success_kitengela.htm
Machakos and Kitui, Kwale and Busia	Kenya forestry initiatives	Bureau of Environmental Analysis International	Ongoing	http://www.beainternational.org/CaseReports.htm
Mount Kenya	Il Ngwesi group ranch and partnership	Lewa Wildlife Conservance	Ongoing	http://www.lewa.org/ilngwesi.php
Nyando, Yala, and Nzoia river basins	Western Kenya integrated ecosystem management project	ICRAF- Kenya Agriculture Research Institute	Ongoing	http://www.isric.org/Webdocs/Docs/GWC2_Lessons%20learned%20(July%202006).pdf
Southern Kenya	Shompole ecotourism development project	Shompole Community Trust	Ongoing	http://www.shompole.com/
	Kenya agricultural productivity and sustainable land management	GEF & the World Bank	Ongoing	http://www.gefonline.org/projectDetails.cfm?projID=2355
Kingangop plateau	Kinangop grasslands important biodiversity area	Nature Kenya	Unknown	http://www.iucn.nl/english/funds/purchase/engels/projecten_eng.htm#ken04
Madagascar				
	JIRAMA water debits for water protection	JIRAMA (Madagascar's Energy Company)	Incipient	http://www.katoombagroup.org/africa/documents/inventories/madagascar%20inventory.doc
Andasibe-Mantadia	Andasibe-Mantadia Biodiversity Corridor	ANGAP	Ongoing	http://carbonfinance.org/Router.cfm?Page=Projport&ProjID=9638
Maroantsetra	Makira conservation site	Wildife Conservation Society (WCS)	Ongoing	http://www.wcs.org/international/Africa/madagascar/makira

Masoala	Masoala National Park	WCS	Ongoing	http://www.wcs.org/sw-around_the_globe/Africa/174291
Namibia				
	Namibia Community Based Natural Resources Management	WWF	Ongoing	http://www.povertyfrontiers.org/ev_en.php?ID=1112_201&ID2=DO_TOPIC
Sierra Leone				
Gola Forest	Sierra Leone forest conservation concession	Conservation Society of Sierra Leone	Ongoing	http://www.cbd.int/doc/external/cop-08/ma-gola-2006-03-27.pdf
South Africa				
Olifants and Sabi Rivers	Developing markets for watershed protection services and improved livelihoods	IIED	Completed	http://www.iied.org/NR/forestry/projects/water.html
Sabie-Sand catchment, Mpumalanga, and the Ge-Selati River, Limpopo Province	Feasibility assessment for implementing payment schemes	IIED and CSIR	Incipient	http://www.isric.org/Webdocs/Docs/GWC2_Lessons%20learned%20(July%202006).pdf
Makuleke region	Makuleke tourism initiative	South African National Parks	Ongoing	http://www.propoortourism.org.uk/safrica_cs2.pdf
Richtersveld National Park	Richtersveld National Park	South African National Parks	Ongoing	http://epp.gsu.edu/pferraro/special/RICHTERSVELDSouthAfricalease.pdf
	Working for water program	South African Department of Water Affairs and Forestry	Ongoing	http://www.dwaf.gov.za/wfw/
	Working for Wetlands Programme	South African Department of Water Affairs and Forestry	Ongoing	http://www.sanbi.org/research/wetlandprog.htm#prog
Cape Floristic Region	South Africa - CAPE biodiversity conservation and sustainable development project	National Botanical Institute of S.A.	Unknown	http://go.worldbank.org/ET73YFR4I0
Tanzania				
East Usambara Mountains and Uluguru Mountains Catchment	Equitable payments for watershed services: Delivering poverty reduction and conservation	WWF	Ongoing	http://assets.panda.org/downloads/factsheet_pes_english.pdf

Pangani River Basin	Pangani River Basin Management Project	IUCN	Ongoing	http://www.panganibasin.com/project/index.html
	Participatory Forest Management in Tanzania	Tanzanian Government	Ongoing	http://nfp.co.tz/forest-cons.html
Pangani River Basin	Pangani River Basin Management Project	IUCN	Proposal	http://www.panganibasin.com/project/index.html
Mvomero	The Participatory Environmental Management Programme	CARE, et al.	Proposed	http://www.katoombagroup.org/africa/documents/inventories/TanzaniaInventory_7-06.pdf
Uganda				
Lake George and Lake Kyoga	Integrated Lake Management Project	DFID, the ILM, MRAG Ltd and CARE	Completed	http://p15166578.pureserver.info/ilm/docs/general/End%20of%20Project%20Summary%20Report.pdf
Lake Victoria Region	Uganda Breweries Ltd. National Wetlands Program - wetlands management and education activities	Uganda Breweries Ltd. (funding)	Completed	http://www.isric.org/Webdocs/Docs/GWC2_Lessons%20learned%20(July%202006).pdf
Budongo Forest Reserve	The Budongo Forest Reserve	UK Dept. for International Development	Ongoing	http://www.odi.org.uk/fpeg/publications/rdfn/22/e-i.html
Bufumira Islands	Bufumira Islands Alternative Energy Demonstration Project	Bufumira Islands Development Association (BIDA)	Ongoing	http://sgp.undp.org/index.cfm?module=Projects&page=ShowProject&ProjectID=3891
Bushenyi District, Western Uganda	ECOTRUST "Trees for global benefits program" in Uganda	ECOTRUST	Ongoing	ftp://ftp.fao.org/agl/agll/kageradocs/08case_studies/ug_paper_trees_carbon_sequestration_summary.doc
Kibale and Mount Elgon National Parks	Kibale and Mt. Elgon National parks collaborative management scheme	Uganda Wildlife Authority (UWA)	Ongoing	http://www.iucn.org/places/earo/pubs/forest/elgonreview.pdf
Mabira Forest Reserve	The Mabira Forest Reserve Eco-tourism Project	National Forest Authority and GEF	Ongoing	http://sgp.undp.org/web/projects/9098/mabira_green_ventures.html
Mgahinga and Bwindi Impenetrable Forest	Bwindi Impenetrable National Park and Mgahinga Gorilla National Park Conservation	Uganda's Ministry of Tourism, Wildlife, and Antiquities	Ongoing	http://www.uwa.or.ug/bwindi.html

Mount Elgon and Kibale National Parks	Elgon/Kibale National Parks carbon sequestration projects	Face Foundation	Ongoing	http://www.stichtingface.nl/disppage.php?op=30401&rp=L13|L21&lang=uk
Ngamba Island	Chimpanzee Sanctuary and Wildlife Conservation Project	Uganda Wildlife Authority (UWA)	Ongoing	http://www.ngambaisland.org/index.php
	Integrated Co-management of Lakes through Beach Management Units	Uganda Government & DFID	Ongoing	http://www.ilm.mrag.co.uk/
West Nile Region	West Nile electrification project	The World Bank Prototype Carbon Fund	Unknown	http://carbonfinance.org/Router.cfm?Page=Projport&ProjID=9616
Multiple Countries				
Uganda and Tanzania	Export Promotion of Organic Products from Africa (EPOPA)	Sida	Ongoing	http://www.grolink.se/epopa/Index.htm
South Africa, Botswana, Namibia, Zimbabwe, Kenya and Tanzania	Conservation Corporation tourism in Africa	CCAfrica	Ongoing	http://www.iied.org/pubs/pdf/full/9066IIED.pdf

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Watershed-based Payment for Environmental Services in Asia

Authors:

Marjorie Huang and Shyam K. Upadhyaya, Winrock International

Prepared by:

Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program (SANREM CRSP)

Office of International Research, Education, and Development (OIRED), Virginia Tech

E-mail: oired@vt.edu
On the Web: www.oired.vt.edu

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Introduction

Across much of Asia, rapid transitions to market-based economies alongside demographic changes are creating an increasingly high demand for watershed services. In urban Asia alone, an estimated 700 million people lack adequate water supplies emanating from upland areas (Dudley and Stolton, 2003). Traditional approaches to watershed management have largely failed to reverse widespread watershed degradation and protect the hydrological services they provide. Consequently, efficient and effective watershed management approaches are being actively sought and/or introduced.

The past few years have witnessed a surge of interest in the development of payments for environmental services (PES) programs in Asia. A number of donor-driven scoping assessments and action research pilot sites are underway – primarily in Indonesia, the Philippines, India, Nepal, Vietnam, and China – to determine what the enabling conditions for establishing PES schemes are. Few "mature" PES programs actually exist in Asia. While premature to conclude just how effective these schemes are, this assessment provides an overview of the lessons learned and best practices of watershed-based PES programs emerging in Asia to date.

Given the ongoing debate on the definition of PES, this assessment adopts the definition of PES as a *voluntary* transaction where a *well-defined* environmental service is being "bought" by at least one environmental service *buyer* from at least one environmental service *provider*, if and only if the environmental service buyer secures the environmental service as a *conditionality* (Wunder, 2005). In reality, few true, market-based PES schemes exist even in developed countries and Latin America where PES experience is greatest. In Asia, mostly donor-driven, poverty alleviation is also being tested as an objective alongside the provision of environmental services, though not essential for a PES scheme to exist.

This assessment is based on a literature review of both published and unpublished materials, and interviews with PES professionals in Asia. Approximately 30 watershed-based PES case studies in Asia were identified (see Appendix A). However, only 15 of these case studies provide sufficient detailed information for analysis. The largest number of PES case studies comes from Indonesia and the Philippines where watershed management has taken on less of a command and control approach and thus, the enabling conditions for establishing PES schemes based on the definition above potentially greater.

A number of factors appear to influence the development of PES programs in Asia, five of which are discussed in this assessment. First, governance structures in Asian countries vary from command-and-control to more decentralized, participatory approaches to watershed management. Such governance structures, in turn, shape the regulations and the required capacities of local and national-level institutions to support a PES framework. Second, in much of Asia, population density is high and land holdings per household are relatively low, potentially increasing PES transaction costs. Third, most forest and agricultural land in Asia are state-controlled with individuals or communities possessing weak property or usufruct rights, thus bringing into question the *voluntary* component of the PES definition. Fourth, as within most developing countries, the lack of hydrological data to establish a relationship between land use patterns and environmental services raises issues of how the *conditionality* aspect of PES is being met. Finally, the level of awareness of the PES concept across Asia is relatively low.

As will be highlighted throughout this assessment, these contextual factors influence the design and development of PES programs in Asia. The next section discusses the various lessons learned and best practices of PES programs within the Asian context.

Design and Development of PES in Asia

With funding from the International Fund for Agricultural Development (IFAD), the World Agroforestry Centre (ICRAF) has played a prominent role in promoting the concept of both cash and in-kind "rewards" for environmental services with their Rewarding Upland Poor for the Environmental Services (RUPES) program in Asia. RUPES is actively implementing pilot action sites in Indonesia, the Philippines, and Nepal, and establishing learning sites in China and other parts of Asia to test the feasibility of "payments" for environmental service programs to address both environmental protection and poverty alleviation. In addition, from 2001-2006, the International Institute for Environment and Development (IIED) conducted scoping assessments in India and Indonesia. A number of international and local organizations are also exploring the feasibility of PES programs in Asia. Collectively, the case studies under these programs begin to point to specific common features related to the design and development of watershed-based PES programs. Such features are broadly categorized here as:

- Environmental Services Provided
- Potential Buyers, Providers, and Intermediaries of Environmental Services
- Design Elements of Payment Mechanisms
- Legal and Regulatory Framework

<u>Environmental Services Provided</u>
In accordance to the PES definition noted above, a well-defined environmental service needs to be clearly identified. Improved total water yield and seasonal flow augmentation; improved quality of water; and general watershed rehabilitation and erosion control are the most commonly reported hydrological environmental services demanded and provided under PES programs in Asia. Landslide prevention and flood control are also mentioned as possible targeted services, but no PES cases were actually found. Once identified, such environmental services can then be valued and performance-based monitoring systems established to develop PES programs, at least in theory.

By far, PES mechanisms reflecting either public payment schemes or self-organized deals most commonly identified in the Asian context are:

- State-owned or para-statal hydroelectric facilities or municipal water supply companies directly or indirectly providing cash payments or in-kind rewards to upland communities in return for the provision of reliable water flows and improved water quality, typically reduced sedimentation or erosion (Indonesia, Nepal, the Philippines).
- A private enterprise, such as a local water bottling or eco-tourism company, agreeing to pay upstream land users via direct or indirect cash payments or in-kind rewards for the provision of improved water quality or quantity (Indonesia).
- A local community, such as a water user association, agreeing to pay upstream users via direct or indirect cash payments or in-kind rewards for the provision of improved water quality or quantity (India).
- The central government itself distributing cash subsidies and in-kind rewards to farmers in return for reduced sedimentation or erosion (China).

Thus, while environmental services demanded are based purely on downstream hydrological needs, the actual PES mechanism adopted is a factor of whether market mechanisms are at work or state regulations are driving watershed management approaches, or a combination of both. In the former case, in China, providers of environmental services, such as farmers, can opt to participate in the *Sloping Farming Lands Conversion Program* PES scheme, but the government publicly finances the program and has ultimate say in terms of how the land is used (Sun and Chen, 2006). In contrast, in India and Indonesia, individual household or communities can voluntarily participate to a greater extent in decision-making processes to

determine how land is used, a factor noted as being more conducive to a true, market-based PES program (Landell-Mills and Porras, 2002).

Potential Buyers of PES

Buyers in Asia have been a mix of both local and national public/private downstream users. By far, municipal water supply utilities, national and local governments, and hydroelectric facilities are the predominant buyers in the case studies reviewed. Cases of private sector interest (e.g. private bottling companies) in payment for environmental services exist though are not as common. In most cases, a single buyer rather than multiple buyers within a PES program is identifiable, thus, potentially simplifying the design of the PES scheme.

However, practitioners point out that in general, there is limited demand among potential environmental service buyers in Asia for PES. As the general concept of PES is still relatively new in the region, potential buyers of environmental services are not aware of the concept. Furthermore, there are few if any successful PES cases; thus potential PES buyers are uncertain if payments or rewards will lead to improved environmental services. Buyers may also require more evidence of scientific linkages between upland land use management and downstream impacts before committing. In Indonesia, where buyers are already paying various taxes to the national and local government and/or putting funds aside for community development activities aimed at social responsibility, PES is also perceived by some as another unwelcome tax or fee (personal communication, Suyanto, May 2007).

Potential Providers of PES

Just as upland areas are typically a mosaic of different land uses – including community farms, government protected areas, and timber concessions – upland users are not homogenous across the Asian landscape. In particular, individual farmers may have land use ownership or rights (private, community-owned, state-owned) or be altogether landless (Francisco, 2005). The widespread lack of land tenure is often cited as a key constraint to developing PES "markets" in Asia (Landell-Mills and Porras, 2002; Sven *et al*, 2005). As a result, some PES action pilot sites in Asia are experimenting with land tenure or land use rights as a payment or reward for environmental services (Winrock International ARBCP factsheet, 2005; Suyanto *et al*, 2005; Leimona, 2005).

Given high population densities in much of Asia, where smallholder farmers have land tenure or usufruct rights, it is typically less than a hectare, potentially complicating the need to coordinate watershed management activities among the various providers to ensure that an environmental service is achieved. Such watershed management activities typically include maintaining existing natural habitats, adopting sustainable agriculture and conservation practices, and/or engaging in reforestation of land rehabilitation (Bond, 2006; Arocena-Francisco, 2003). Thus, in most if not all cases, environmental service providers are more likely to be ad hoc or formal groups of individuals, such as associations of water users, farmers, and forestry operators.

In Asia, smallholder farmers also typically tend to be poor and at a distinct disadvantage if a capable or trustworthy intermediary is absent to advocate on their behalf. In India, within watershed development programs, benefits have been noted to go disproportionately to rich landowners rather than the poor (Sengputa *et al*, 2003). Typical of the poor around the world, the poor in upland communities in Asia may be unfamiliar with formal contracts; are poorly educated; and due to weak property rights, are unable to guarantee that they will be able to influence land management decisions to provide watershed services (Landell-Mills and Porras, 2002) and/or lack the incentive to adopt "long-term" behavior changes in support of environmental services. Evidence also suggests that in some circumstances, marginalized, community members and landless farmers could lose access to common lands, and experience declining livelihoods unless poverty alleviation is considered in program design. Again, group-based rewards, such

as tenure security for the whole group, can potentially prevent the poor and weak from being manipulated or expropriated by wealthier members of the group.

Intermediaries of PES

Intermediaries, such as local and international non-governmental organizations, research institutes, community-based organizations, and government officials at various levels, have played a critical role in linking the providers and the buyers of the environmental services. In Asia, such intermediaries provide a range of services including: increasing public awareness, serving as a clearinghouse for information, training, capacity building, negotiating, monitoring and evaluation, resolving conflicts, absorbing transaction costs, and conducting scientific and socio-economic feasibility assessments on the potential of PES in various watersheds. Intermediaries have also helped generate collective action, providing support for weaker members of communities to better address poverty alleviation or ensure that the poor are not made worse off. Local institutional capacity to provide such services varies across Asia, but is generally low.

In the case studies reviewed, the majority of intermediaries were local NGOs and international donors and organizations. For instance, in Sumberjaya, Indonesia, ICRAF and a local non-governmental organization provided technical and financial assistance to assist farmer groups in obtaining land tenure for five years on a probationary basis in exchange for participating in community forestry schemes to support watershed rehabilitation and erosion control. After five years, farmer groups are then eligible to obtain an additional 25 years of land tenure (Suyanto *et al*, 2005; Leimona, 2005). In Lombok, Indonesia, the local Bestari Foundation is responsible for collecting and administering funds to implement PES activities to support watershed conservation – increasing public participation, empowering upstream and downstream communities, and related activities (WWF, BESTARI Community Fund, and KONSEPSI, 2007). In Kulekhani, Nepal, Winrock International has also played an important role in developing a watershed-based PES mechanism in mobilizing buyers and suppliers and raising awareness on the PES concept to provide reliable water flows and reduced sedimentation or erosion for a downstream hydroelectric facility (Upadhyaya, Shyam K, 2006).

Local governments have also served both as key buyers and facilitators supporting PES efforts. For instance, in the Philippines, the governor of Illio City was instrumental in getting the local water district to agree to transfer payments, as mandated by law, to the local government district. As a result, these funds are earmarked for community PES-related watershed projects (Arocena-Francisco, 2003). Local government officials are also in a better position to understand the local context and to build relationships with community members through more periodic interactions.

It has been said that trust is essential between the providers and buyers of environmental services, and intermediaries for PES programs to be successful (interview with Meine van Noordwijk, May 2007). Intermediaries must develop a close relationship with both the providers and buyers to serve as effective go-betweens. In India, a valuation study found that households were willing to pay up to 240 Rupees per annum (US$5) for the conservation of the Bhoj Wetlands provided that their voluntary contributions were channeled to a trusted intermediary. In this case, an independent institution was established to act as the intermediary (Sengupta *et al*, 2003). Similarly, in Indonesia, in the Cidanau watershed, a legal intermediary organization, the Cidanau Watershed Communication Forum, had to be created before PT Krakarau Tirta Industri (KTI), an industry that provides water to small and big companies, would enter into a PES agreement with potential PES providers (Leimona and Prihanto, 2005). In terms of PES schemes, such trust between the providers and buyers of environmental services is particularly essential given that in most cases, future payments/rewards and environmental services are expected. Without intermediaries, the potential of PES at many of these sites in Asia would probably not be realized, at least in the short-term.

Design Elements of Payment Mechanisms

Developing payment mechanisms that are able to get the incentives right and induce long-term behavior change has proven a challenge in the Asian context as elsewhere. Determining the appropriate length of contract, type of payments or rewards, fee structures and targeting, and transaction costs all factor in on the incentive package needed to convince potential providers and sellers of environmental services of the potential benefits to actively participating in PES programs.

Length of contract. In the case studies reviewed, rather than being a one-time exchange of payments/rewards and environmental services, typically, contracts between buyers and sellers are initially negotiated for a couple of years with the potential to be re-negotiated and extended if a demand still exists once the contract period ends. In China, under the *Sloping Farming Lands Conversion Program* aimed at reducing soil erosion, contracts to convert farming and barren lands are recognized for up to 50 years, can be inherited and transferred, and can be extended upon expiration. The program is touted as being widely popular with significant economic and social benefits to the farmers who have volunteered to participate in the program. Farmers voluntarily convert unsuitable, sloping farmlands into forests and grasslands in exchange for cash subsidies or free grain or subsidies (Sun and Liqiao, 2006). More typical are shorter contracts, such as in the Cidanau watershed in Indonesia, where the PT Krakatau Tirta Industri (KTI) company is voluntarily paying upland communities to maintain forest cover on a 50 hectare pilot site over the course of two years with the possibility to renegotiate and extend for an additional five years thereafter (Leimona and Prihatno, 2005). In general, payments or rewards for environmental services should last as long as the environmental service is demanded to send the right incentive signals to key stakeholders of the PES program.

Type of payments or rewards. Where awareness of the concept of PES exists, Asian upland communities have been found to participate in PES schemes for cash payments. Such cash payments typically flow to a group, which has established rules, written or verbal, on how to manage PES payments/community funds for the benefit of the community as a whole. Rarely, if ever, is cash transferred directly to individual households in the Asian case studies reviewed. For example, in Lombok, Indonesia, a multi-stakeholder management board oversees the Bestari community fund determining how payments are to be managed; how the fund will serve both upland and downstream communities; and what the rules of enforcement to ensure the continuous flow of services and payments between prospective buyers and providers of environmental services are (WWF *et al*, 2007). Similarly, in the Kulekhani watershed in Nepal, hydroelectric royalties are deposited to an Environmental Management Special Fund (EMSF) via the Makwanpur District Development Committee to support conservation and development programs at the community level (Upadhyaya, 2006). In return, service providers have to adopt watershed management practices that will lower sedimentation loads and improve water flows affecting the hydroelectric facility.

While cash payments are often welcome, interviews with local community members indicate that oftentimes, cash is not enough to offset the opportunity costs of foregoing unsustainable land use practices. Several RUPES sites also found that per capita royalty distributions for water supply services from hydropower plants were insufficient to impact poverty. For example, in Singkarak Lake, Indonesia, the local community unit received close to USD $40,000 or only US$1 per capita in 2005 as its first allocation of hydropower royalties (ICRAF, site profile RUPES Singkarak). Similarly, in the Kulekhani watershed in Nepal, payments from hydropower royalties amounted to about USD $1.50 per capita (ICRAF, site profile RUPES Kulekhani).

Yet, local communities do appear to potentially benefit where cash payments are complemented with in-kind rewards, such as secure access to land for farming or technical assistance or training, with the potential to lead to additional incomes and benefits. In particular, agroforestry and multipurpose species training have a multiplier effect as harvested crops can be used for subsistence and sold. In Vietnam, for instance, the average smallholder farmer received an average annual payment from a pilot PES scheme of

US$15, making up only 2% of household income. This low payment was attributed to the inability of poor farmers to commit more than 1.5 hectares to the scheme. However, the farmers were willing to participate in the scheme as many were seasonally unemployed and they valued the additional forest management training and technical assistance provided (Bui and Hong, 2006).

Thus, in designing PES programs, it would appear that some form of layering of payments or rewards is necessary to create an attractive incentive package. Such an attempt is being made in Vietnam under the USAID-funded Asia Regional Biodiversity Conservation Program where PES and other financial mechanisms, such as the development of sustainable rural enterprises to increase the benefits to smallholder farmers, are being layered on top of one another (Winrock International ARBCP factsheet, 2005).

Fee Structures and Targeting. The literature review does not indicate that targeting is used to direct payments to service providers providing the greatest environmental service benefits. Rather, evidence points to cash payments being paid mostly as flat fees or flat per hectare fees. For instance, in Indonesia, PT Krakatau Steel, a state-owned water supply enterprise, voluntarily agreed to pay Rp 3,500,000 (US$392) per hectare yearly for a 50 hectare-pilot site. At the end of five years, the community is expected to have at least 500 fruit or timber trees standing in the pilot site for the purpose of providing water quality and flow services downstream (Leimona and Prihatno, 2005). While implementing flat (per hectare) fees is easier to implement, scholars argue that it is less efficient and could conceivably sends the wrong incentive signals.

Efforts to experiment with differentiated fees based on the level of environmental services provided are few. In one case, in Sumberjaya, Indonesia, a payment scheme is being explored whereby a hydropower facility in Sumberjaya has indicated a willingness to make payments at different levels based on actual sediment reductions achieved by watershed protection activities. RiverCare community members are taught how to monitor the effectiveness of erosion control techniques and sedimentation using simple, low cost measurement approaches (ICRAF, RUPES Sumberjaya Brief No. 2).

It should be noted that where conditionality is not tied to the disbursement of fees, though, a PES program does not exist. In Asia, few PES activities have performance-based monitoring and evaluation components to determine if the targeted area is providing the intended environmental service to determine this *conditionality* factor. In part, this factor is due to a lack of scientific data and knowledge linking upland activities with downstream impacts. In India and Indonesia, it has been said that reliable hydrological data are noticeably absent with government and local institutions often lacking the capacity to collect and analyze such information (Geoghegan, 2005). The difficulty in developing measurable indicators to address the conditionality factor has also been noted. Regardless, PES schemes have moved forward despite this lack of hydrological data, bringing into question long-term sustainability issues.

Similarly, few socio-economic poverty indicators are being collected to determine if the poor are benefiting from PES schemes. As a start, the RUPES program has recently prepared baseline indicators to monitor the impact of PES on poverty alleviation in its six pilot sites in Indonesia, Nepal, and the Philippines. Since poverty is so pervasive in upland areas, the poor may be service providers and thus, receive payments or rewards under a PES scheme by default. However, it should be noted that where poverty alleviation becomes an additional objective, the effectiveness and efficiency of PES schemes to reach environmental service objectives may diminish, though in Asia, little research has been conducted to support this claim.

Transaction Costs. Transaction costs are those costs required to establish and manage a PES program. Such transactions costs can be high where the negotiation process is long; the process of distributing payments is bureaucratic; inefficient, hydrological data is missing for monitoring purposes; and

awareness is low, among other factors. In most of Asia, the capacity of existing local institutions to confront and resolve these challenges is considerably low, thus, potentially increasing the transaction costs needed to increase this capacity.

In the few cases that even mention transaction costs, evidence indicates that these costs are often excessive and could hinder PES program success. For instance, one study found that the estimated transaction cost to establish and operate a land tenure rights (HKm) group in Sumberjaya, Indonesia was about Rp 504,000 (US$55 at the current exchange rate) per household. Such costs include covering the time and effort needed to "negotiate" or prepare, process, and approve the HKm applications submitted to the local and national-level government. Given that the average annual farm household income is Rp 1 million (US$109) or less, this transaction cost was considered excessive (Arifin, 2005).

Presumably, one way transaction costs could be lowered is where payments are distributed to a collective village institution rather than individual households, particularly where the people-to-land area ratio is high, as is widely found in Asia. National and local institutions, such as local government, could also lower the transaction costs of village institutions if they have the capacity and resources to carry out intermediary services and absorb such costs as monitoring and evaluation. In general, little data on transaction cost is available to determine if these claims are true, but they make intuitive sense.

Legal and Regulatory Framework

Despite a lack of PES- specific supportive legal and regulatory frameworks, attempts to establish PES programs have gone forward where motivated service providers and beneficiaries have come together to address watershed degradation. Currently, no country in Asia has laws and policies explicitly and directly supporting PES. The fact that so few PES schemes have been implemented in Asia warrants a closer examination on how policies could help to support sustainable PES schemes. Current discussions at PES workshops in Asia include the extent to which PES laws and policies should be changed and the level of government most likely to support PES laws and regulations in the short-term.

Opinions concerning the necessity of PES enabling laws and policies range from the belief that existing national and local policies are adequate or only need minor modifications to support PES to the belief that entirely new PES enabling legislation is needed (Padilla *et al*, 2005; Arifin, 2005). Throughout Asia, a number of key policies already address ecosystem conservation and protection, revenue generation, and poverty alleviation, providing indirect support to the objectives of PES. However, current legislation does not specifically require that funds be earmarked directly to service providers or that beneficiaries pay for environmental services. In Indonesia, national-level laws mandate that state-owned companies pay royalties to both national and local governments, and a portion of the local government's royalties is to be distributed at the provincial and district levels. Royalties, though, are not transparent to local communities, or specifically earmarked as incentives to enhance environmental conditions to address poverty alleviation.

Both national and local government laws, regulations, and agencies play a pivotal role in supporting PES initiatives at the local level. However, local laws and regulations are often easier to pass. For example, an initiative is underway in Lombok, Indonesia for a regional/local regulation to support collection of payments from water bills for a PES program to protect water resources and promote tourism (WWF, 2007). The regulation will provide a mechanism through which funds can be collected and dispersed for conservation and poverty alleviation purposes. In Nepal, the Ministry of Local Development has also issued a guideline suggesting that 20 percent of hydropower royalty received by local districts be utilized for the protection of upland watersheds. Due to efforts under the RUPES program, in the Makawanpur District, part of this royalty is then allocated to a PES fund, which supports conservation and development programs (Upadhyaya, 2007). Local governments are typically also in a better position to develop legislative frameworks reconciling both customary and formal laws.

Yet, addressing PES at the national level is considered equally important. Efforts on the ground are underway in Asia to identify where policy changes can provide a more supportive framework for the development of PES. In Vietnam, under the USAID-funded Asia Regional Biodiversity Conservation Program, Winrock and the World Conservation Union (IUCN) are working closely with national-level government officials to incorporate PES language into the draft Biodiversity Law (Winrock ARBCP factsheet, 2005). In Indonesia and the Philippines, ICRAF's RUPES program has initiated policy working groups reflecting a cross section of policy makers, NGOs, academic institutions, and other interested stakeholders to conduct policy reviews and develop a supportive legal framework for PES in the respective countries.

Conclusion

Asian countries are at different stages in exploring the potential of PES programs to provide environmental services. Indonesia and the Philippines have the largest number of documented PES schemes. All PES schemes are still in their testing/pilot program stage. Consequently, only preliminary lessons learned and best practices of the opportunities and challenges to implementing PES programs are available.

Much debate has been made on whether the definition of PES (as mentioned in the Introduction) is too restrictive and whether it should be broadened to include poverty alleviation. Yet, in reality, PES schemes have not yet proven that they can reduce poverty, though, in many cases in Asia, it would seem that poverty alleviation would automatically be addressed as the poor are often the dominant land users in areas affecting the desired environmental service. Another debate is on whether PES schemes can be truly *voluntary* where governments have and exercise tight control over land use, as in much of China and Vietnam. Some scholars posit that PES-like schemes encompassing a mixture of a command-and-control and voluntary framework would be more appropriate in these select cases.

While determining the feasibility of PES schemes is highly local and context specific, a number of factors indicate that PES schemes can be designed from the start to ensure a higher likelihood of success in Asia. Such design factors include clearly defined environmental service provisions; demand on the part of buyers, providers, and intermediaries for environmental services; payment mechanisms designed to provide the right incentives package; and increased political willingness on the part of national and local governments to develop policies in support of PES. Yet, even so, much more pilot action research is needed to gain a clearer understanding of how to design PES programs to efficiently and effectively address watershed protection in Asia.

The general sense among PES practitioners is that given the complex nature of poverty and environmental services, PES schemes alone are unlikely to induce the necessary incentive-based behavioral changes to achieve environmental, and potentially, poverty alleviation, goals in Asia. Rather, PES will likely need to be coupled with other complementary, alternative approaches to ensure poverty alleviation and the sustainable flow of hydrologic and other environmental services.

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Appendix A

Asian Case Studies Reviewed

Indonesia	**Status (Proposed or Emerging)**[25]	**Sellers/Buyers**	**Payment or Reward**	**Citation**
Lombok – Bestari community fund	Proposed	*Sellers:* Communities *Buyers:* Municipal water supply company (PDAM)	Proposal to earmark PDAM water bill to contribute to in-kind rewards	Leimona and Prihatno (2005).
Lake Singkarak	Proposed	*Sellers:* Communities *Buyers:* State hydroelectric power company	Cash	http://www.worldagroforestrycentre.org/Sea/Networks/RUPES/download/SiteProfiles/RUPES-Singkarak_FINAL.pdf
Sumberjaya – Way Besai watershed, Lampung	Ongoing – land concessions; proposed	*Sellers:* Communities *Buyers:* State forestry department; State hydroelectric power company	Cash and in-kind land tenure	http://www.worldagroforestrycentre.org/Sea/Networks/RUPES/download/SiteProfiles/RUPES-Sumberjaya_FINAL.pdf
Segara River Basin, Lombok	Proposed	*Sellers:* Communities/farmers *Buyers:* State owned water supply company; rafting company	Cash through land tax PDAM pays to local government and from rafting company	Suyanto *et al* (2005).
Brantas River	Proposed	*Sellers:* Forest Service and Communities *Buyers:* Hydropower electric station	N/A	Munawir, Salim, Suyanto and Vermeulen (2003).
PT Indonesia Asahan Aluminum (INALUM)	Ongoing	*Sellers:* District governments *Buyers:* Aluminum refinery and power generation company	Cash	Suyanto *et al* (2005).
Cindanau Watershed, Benten Province	Ongoing	*Sellers:* Communities/farmers and protected areas *Buyers:* Private	Cash	Suyanto *et al* (2005).

[25] [25] PES schemes range from "proposed" schemes where "payments" or "rewards" are not yet flowing to "ongoing" schemes where "payment" or "rewards" have begun to flow.

		hydroelectric power company		
Bandung, West Java	Proposed	*Sellers:* Community *Buyers:* State-owned water supply enterprise	In-kind - agroforestry training	Suyanto *et al* (2005).
Cicatih Watershed, West Java (CIFOR)	Proposed	*Sellers:* N/A *Buyers:* Water bottling companies; ecotourists	N/A	http://www.worldagroforestry.org/sea/ networks/rupes/download /Annual_Reports/ 2006/Appendix_4.pdf
Kapuas Hulu (WWF, CARE, IIED)	Proposed	*Sellers:* Communities *Buyers:* Public water service; districts; provincial government; industry	N/A	WWF, (2006).
Atambua (WWF, CARE, IIED)	Proposed	*Sellers:* N/A *Buyers:* N/A	N/A	http://www.worldagroforestry.org/sea/ networks/rupes/download /Annual_Reports/ 2006/Appendix_4.pdf
Barugae, Mamappang watershed	Proposed	*Sellers:* Community in Barugae *Buyers:* Community group in Mamappang and Matajang	N/A	
USAID – Environment Services Program	Proposed	*Sellers:* Communities, Park, *Buyers:* Private bottling company, industries, water supply company	N/A	http://www.esp.or.id/
Philippines				
Makiling Forest Reserve	Proposed	*Sellers:* Communities *Buyers:* University of thr Philippines Los Banos	Cash and in-kind (various)	Arocena-Francisco, (2003).
Maasin Watershed	Proposed	*Sellers:* Communities *Buyers:* Metro Iloilo Water District	In-kind (various)	Arocena-Francisco, (2003).
Northern Sierra Madre Natural Park (NSMNP)	Proposed	*Sellers:* Communities *Buyers:* Department of Environment and Natural Resources	In-kind (land tenure and access to forest resources)	Arocena-Francisco, (2003).
Mt. Kanla-on Natural Park – The Kanla-on Spring Plant	Proposed	*Sellers:* People's Organizations (PO)/Communities *Buyers:* Local bottling company	Cash and in-kind (land tenure; social development activities)	Arocena-Francisco, (2003).
Bakun,	Proposed	*Sellers:* Communities	Cash	http://www.worldagrofor

Bengeret Province		*Buyers:* Two hydroelectric power plants		estrycentre.org/ Sea/Networks/RUPES/download/ SiteProfiles/RUPES-Bakun_FINAL.pdf
Kalahan Forest in Nueva Vizcaya (REECS)	Proposed	*Sellers:* Communities *Buyers:* Hydropower dam	N/A	http://www.worldagroforestrycentre.org/ Sea/Networks/RUPES/download/ SiteProfiles/RUPES-Kalahan_FINAL.pdf
Penablanca Protected Landscape (REECS)	Proposed	*Sellers:* Communities *Buyers:* domestic water users, rice farmers with irrigated lands, and tourists	N/A	Bennagen, (2003).
Cantingas/Panangcalan watershed	proposed	*Sellers:* Communities *Buyers:* Mini-hydro plant	N/A	WWF, (2006).
Baticulan Watershed	N/A	*Sellers:* Communities *Buyers:* Municipal water company (?)	N/A	http://www.worldagroforestry.org/sea/networks/ rupes/download/Annual_ Reports/2006/ Appendix_4.pdf
Sibuyan Island	N/A	*Sellers:* Communities *Buyers:* Municipal water company (?)	N/A	http://www.worldagroforestry.org/sea/networks/ rupes/download/Annual_ Reports/2006/ Appendix_4.pdf
Lantapan, Bukidnon	N/A	*Sellers:* Communities *Buyers:* Hydroelectric power (?)	N/A	http://www.worldagroforestry.org/sea/networks/ rupes/download/Annual_ Reports/2006/ Appendix_4.pdf
Nepal				
Kulekhani watershed	Ongoing	*Sellers:* Communities *Buyers:* Hydroelectric power facility	Cash	http://www.worldagroforestrycentre.org/ Sea/Networks/RUPES/download/SiteProfiles/ RUPES-Kulekhani-FINAL.pdf
India				
Gulbargan, Karnataka	Proposed	*Sellers:* Communities/farmers *Buyers:* Downstream communities/ farmers	N/A	Rowcroft (2005).
Himachel Pradesh	Proposed	*Sellers:* N/A *Buyers:* Central	N/A	Rowcroft (2005).

		government on behalf of downstream states		
Sukhomajri	Ongoing	*Sellers:* Communities *Buyers:* Downstream communities	In-kind	Kerr, (2002).
Rajasthan	Ongoing	*Sellers:* village *Buyers:* Downstream villages	N/A	Rowcroft (2005).
China				
Upper reaches of the Yangtze and the Upper and Middle Reaches of the Huang He River	Ongoing	*Sellers:* Farmers *Buyers:* State government	In-kind (free grain and seedlings); cash subsidies	Sun, Changjin and Chen Liqiao. 2006.
Guangdong Province	Proposed	*Sellers:* Communities *Buyers:* Water supply and hydroelectric enterprises	N/A	Rowcroft (2005).
Hebei Province	Proposed	*Sellers:* Province *Buyers:* Water supply authorities	N/A	Rowcroft (2005).
Jiangxi Province	Proposed	*Sellers:* Xingguo county *Buyers:* Local industries	N/A	Rowcroft (2005).
Shiangxi Province	Proposed	*Sellers:* Forestry Department *Buyers:* Water supply authorities	N/A	Rowcroft (2005).
Pakistan				
Mangla Dam	Ongoing	*Sellers:* Farmers *Buyers:* Water and power development authority	N/A	Rowcroft (2005).
Vietnam				
USAID – Asia Regional Biodiversity Conservation Program	Proposed	*Sellers:* Communities *Buyers:* Municipal water supply	In-kind: land usufruct rights	

Appendix B

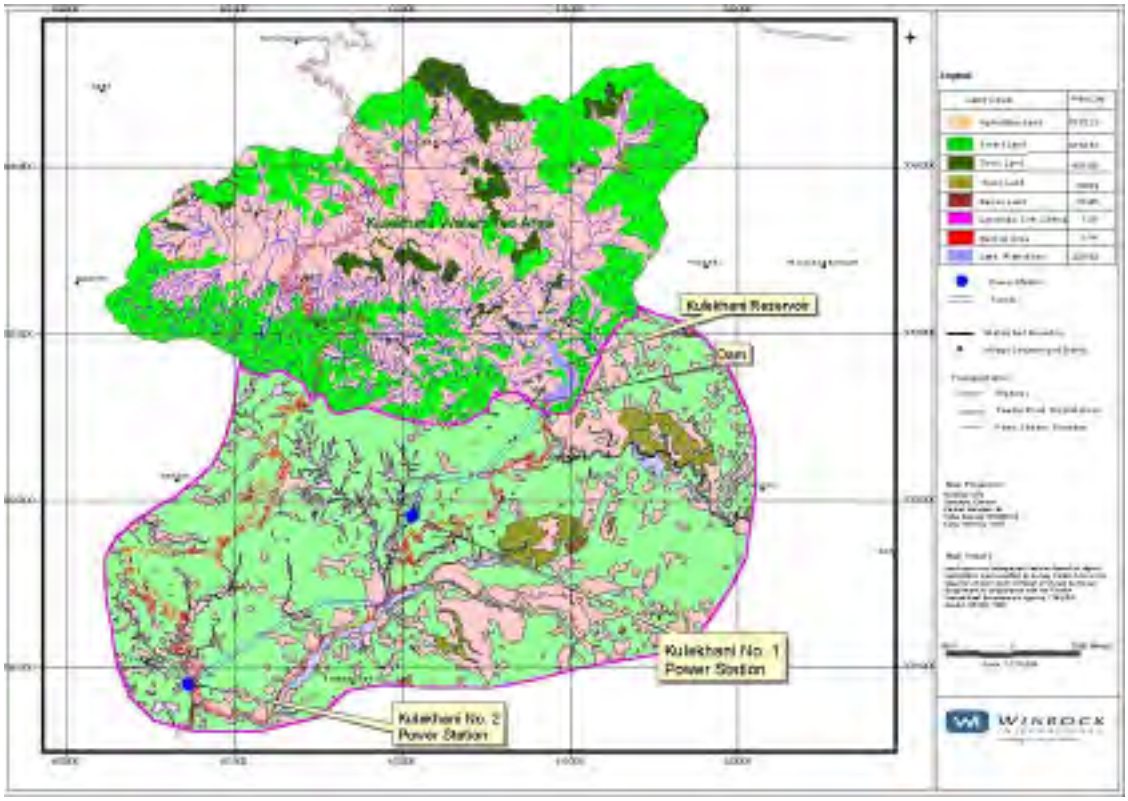
CASE STUDY

PES Mechanism in Kulekhani Watershed, Nepal

Introduction

Located about 50 Km southwest of Kathmandu, the Kulekhani watershed is the source of water for the Kulekhani reservoir, built in the late 1970s, which supplies water to two hydropower plants located further downstream. Figure 1 illustrates the location of the watershed and reservoir. The total area of the watershed is about 12,500 hectares, with 53 percent of the watershed in forest. About 45,000 people live in the watershed.

Figure 1: Kulekhani Watershed, Reservoir, and Hydropower Plants



By conserving forests and undertaking other conservation activities, people residing in the Kulekhani watershed are supplying valuable environmental services. There is evidence that forest conservation has reduced the rate of sedimentation to the reservoir. Evidence also suggests that forest conservation has increased dry-season water-flow to the reservoir. These environmental services provide more water to the reservoir, which in turn increases electricity revenue and reduces maintenance costs of the hydropower developer (Nepal Electricity Authority). These environmental services also add to the revenue of the government of Nepal as the hydropower company pays taxes and royalties to the central government.[26]

Until recently, the people of the Kulekhai watershed received no benefits for providing these services. In the past, the government of Nepal and donor agencies provided incentives to upland people to undertake conservation activities. The termination of those programs and the high level of poverty among upland people are threatening to reduce these environmental services. The RUPES program is working with upland people and the beneficiaries of these environmental services to develop a mechanism to reward upland people for continuing to provide and enhance environmental services.

PES Mechanism

One of the first tasks of the RUPES program was to establish a relationship between land management patterns and flow of environmental services. Similar to other parts of Nepal, the nationalization of forests had already initiated deforestation processes in the Kulekhani watershed. Deforestation accelerated between the late 1970s and early 1980s when the Kulekhani hydropower plants were built. In the mid-1980s, the government and donor agencies launched participatory watershed conservation programs in Kulekhani watershed. These programs encouraged upland people to form community forestry users' groups. The results were encouraging. Analysis of land use patterns showed that forest cover declined between 1978 and 1992, but by 2001, forest cover increased compared to both 1978 and 1992 levels. Forest cover increased by 2001 because trees planted in the mid- to late 1980s began to mature by the late 1990s. The analysis of sedimentation patterns also indicated that rates of sedimentation to the Kulekhani reservoir had declined greatly by the late 1990s. The decline in the rate of sedimentation corresponds with the increase in forest cover. Analysis of dry-season water-flow also indicated that water-flow to the reservoir increased as the forest cover increased.

The next task in developing a PES program was to identify potential buyers. The Nepal Electricity Authority (NEA), central government, and local government appeared as be potential buyers. The 1992 Electricity Act requires hydropower developers to pay a certain percent of their electricity revenue as a royalty to the central government. The Local Self-Governance Act (1999) requires the central government to share 12 percent of such royalty with the local government of the district housing the hydropower plant, Makawanpur District Development Committee (Makwanpur DDC) in this case.[27] RUPES worked with Makwanpur DDC and local communities of Kulekhani watershed to establish an appropriate PES mechanism.

In early 2006, Makwanpur DDC and the local government body of the district housing Kulekhani I and II hydropower plants established an Environmental Management Special Fund (EMSF). As per the decision, EMSF receives 20 percent of the hydropower royalty received by Makwanpur DDC from the Kulekhani hydropower plants, amounting to about US$55,000 per year. The fund will be used to support conservation and development programs proposed by upland people of the Kulekhani watershed.

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[26] See Upadhyaya (2003).
[27] See Upadhyaya (2003).

Characteristics of PES Mechanism

Voluntary - As a buyer of environmental services, Makawanpur DDC has some flexibility to walk out of the deal although it may have to face political pressure from upland communities. Upland people also have some flexibility in that they may as a group choose not to join the PES scheme and use forests in a way that does not preserve environmental services. However, the law does not allow them to deforest the area completely. If the upland people as a group decide to commit to PES agreement, individual households in the watershed would have to face group pressure for not complying with the agreement.

Conditionality - Makawanpur DDC has prepared guidelines for the use of the EMSF fund. The guidelines have two conditions for the use of EMSF fund. First, the projects to be funded by EMSF should enhance or at least not diminish environmental services. Second, priority should be given to poor and disadvantaged groups while selecting EMSF projects. The impact on environmental services could be measured both at the input and output level. At the output level, the Nepal Electricity Authority (the owner of Kulekhani I and II hydropower plants) has a system in place for monitoring daily inflow of water to the reservoir and also for annual measurement of sedimentation in the reservoir, which will provide indicators for monitoring the long-term impact of EMSF projects on environmental services. In the short run, the effectiveness of EMSF projects will be assessed by measuring and comparing forest cover and quality with baseline scenario conditions, and quantifying implementation of erosion-control activities, such as terracing of sloping lands, gulley control, and construction of check dams. The RUPES program has helped to prepare indicators for monitoring the impact of EMSF projects on poverty and livelihood of the suppliers of environmental services.

Supplier Initiated – In the Kulekhani case, suppliers approached the buyers and asked for payments for environmental services, which were being supplied for free. Past conservation efforts by upland people were successful in rehabilitating degraded forests. At present, the forest condition is relatively good and there is no pressing demand from buyers to change conservation behavior of upland people although there is always scope for enhancing environmental services. Pagiola (2000) argues that PES mechanisms that are initiated by the buyers of environmental services have a better chance of success. It remains to be seen whether the PES mechanism in Kulekhani is sustainable in the long run.

Large number of suppliers - About 8,000 households live in the watershed and are the environmental service providers. Given the limited size of the reward and the large number of suppliers, cash payment to individual households did not appear as an attractive option and people opted for reward in the form of conservation and development projects.

Lessons from Kulekhani for Designing New PES Mechanisms

Role of Research: Research played an important role in establishing the Kulekhani PES mechanism. In Kulekhani, Winrock International and other organizations conducted socio-economic and bio-physical research to establish a relationship between land use pattern and environmental services and to identify potential buyers.

Property Rights: A well defined property right is often considered a pre-requisite for the development of a PES market. Forests in most Asian countries are owned by the state. The government ownership of forest poses a problem in developing forest-based PES mechanisms. However, the Kulekhani case illustrates that it is possible to develop PES mechanism over common property resources as long as people have user rights over such resources.

Prior to the 1950s, local communities in Nepal were free to manage and use forests in their vicinity. People considered forests as their own property and took good care of it. In the late 1950s, the government of Nepal nationalized forests, established pillars to demarcate forest area, and employed forest guards hoping to increase forest cover and quality. The result was quite the opposite. The following few decades experienced massive deforestation in Nepal. Many government officials entrusted with the responsibility of protecting forest engaged in corruption as nationalization created an opportunity for them to get rich quickly. The local community no longer considered the forest as their own property and started competing with each other to destroy more and more forest areas, setting a "tragedy of commons" scenario in motion.[28]

By late 1970s, the government of Nepal realized that its policy was not working. Subsequently, the government introduced the concept of community forestry and granted limited management and user rights of forests to local communities. Under this concept, a number of households formed a Community Forest Users' Groups (CFUGs) to manage a particular patch of forest which they traditionally used. The CFUGs then prepare a management plan and submit it to the district forest office for approval. If the management plan meets conditions specified by the district forest office, then the forest would be registered as a community forest. Community forestry grew rapidly in the following decades. The 1993 Forest Act and regulations formally recognized this concept.

Community forests are not substitutes for private property. The government has put many restrictions on what the community can and cannot do in community forests. In general, it is considered as unreasonably protection oriented. Nevertheless, community forests have been effective in regenerating forests, especially in the hills of Nepal.

More than 95 percent of forests in Kulekhani watershed are community-owned. The buyers of environmental services recognize that community forestry allows local people the right to manage forests in a way that could increase or decrease environmental services. Communities could also recount deforestation experience of 1960s and 1970s to warn buyers of environmental services what could happen if they do not pay them for good forest management.

Role of Intermediary Organizations - There is a role for intermediary organizations such as non-governmental organizations in the initial stage of PES mechanism development. Suppliers of environmental services are not often aware of the value of environmental services. Intermediary organizations are also needed to facilitate the negotiation process between buyers and suppliers of environmental services.

Transaction Cost - There are costs involved for activities such as identification and valuation of environmental services, awareness building, social mobilization, negotiation, and monitoring. In the case of Kulekhani watershed, given the large number of suppliers and few potential buyers, it was not feasible to have one-to-one negotiation between buyers and sellers. Sellers needed to be organized for collective action and social capital needed to be built for that. Buyers and sellers needed to be brought together for negotiations. All these activities involved costs, which the buyers and suppliers of environmental services were believed unlikely to bear. Additional investment was and is still needed to make the Kulekhani PES mechanism sustainable. Once the PES mechanism is established, there will be additional annual operation and management costs. Buyers or sellers of environmental services must be willing to bear these operation and management costs.

[28] See Upadhyaya (2006).

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Appendix C

CASE STUDY
Sumberjaya Case Study

Introduction

Sumberjya is a sub-district in the Bukit Barisan mountain range in Western Sumatra, Indonesia. Sumberjaya forms the Way Besay upper watershed which supplies water to a 90 MW run-of-the river hydroelectricity plant located downstream. This watershed is also the source of water to Tulang Bawang River, which is one of the three main rivers of Lampung Province. The total area of Sumberjaya is about 55,000 hectares, of which 40% is classified as "protection forest" and about 10% as a National Park. The total population of Sumberjaya is about 87,000.

During the 1980s, multi-strata coffee farming increased rapidly in the forested area of the watershed (Kerr et al., 2006) The government saw coffee farming as a threat to watershed functions and forcefully evicted farmers and burned their coffee fields a number of times. However, given the high population pressure and increased coffee prices, it was difficult to keep farmers away. After the fall of the Suharto regime, and the establishment of a more people-friendly government, farmers started moving back to the area again and returned to coffee farming.

There are a number of potential buyers for the environmental services of this watershed. The hydroelectricity company would like to reduce sedimentation and the forest department would like to protect carbon sequestration and other watershed functions of the forest. Downstream residents would like to have quality drinking water. These environmental services must be provided while simultaneously protecting the livelihoods of the many poor farmers in the watershed.

Fortunately, research by the World Agroforestry Centre (ICRAF) and other agencies have shown that coffee based agro-forestry system can provide environmental services and improved livelihoods for farmers. This research provided an opportunity to implement PES mechanisms to conserve environmental services by rewarding farmers.

PES Mechanisms

Two types of PES mechanisms have been developed to date. First,under the recently introduced Hutan Kamasyarakatan (HKm) or social forestry program, the government grants conditional land tenure to coffee farmers in protection forests if they agree to follow recommended cultivation practices and conserve remaining patches of natural forests. A number of farmers in an area form a HKm group. The group, with the help of a facilitator, prepares a map of the forest area, prepares a management plan, and submits it to the government forestry office for approval. The approval process is slow and may take up to three years. If the proposal is accepted, the government initially grants HKm permit to the group for a period of five years, which could then be extended for another 25 years. In particular, farmers are required to plant 400 timber and fruit trees other than coffee per hectare of coffee farm in order to qualify for conditional land tenure. Initially, the tenure is given for a period of 5 years, which can then be extended

for 25 years if farmers comply with conditions.[29] By July 2006, 18 farmer groups had received conditional land tenure covering 11,633 hectares, about 70 percent of protected forest area.

Another PES mechanism involves the formation of the RiverCare group composed of people living around a hydropower reservoir. The group is tasked with reducing sediment loads to the hydropower plant through activities such as the construction of check dams, construction of drainage along the pathways, and terracing. In turn, the group receives "rewards" for undertaking such activities. As a start up, the RUPES program agreed to be the stand-in buyer with the hope that the hydropower company would come in as a buyer once it started seeing benefits. As per the current agreement, the RUPES program would make the following payment to RiverCare if, by the end of 2007, sediment loads are reduced as follows:

- $1,000 for a 30% reduction;
- $700 for a 20 to 30% reduction;
- $500 for a 10 to 20% reduction, and
- $250 for a less than 10% reduction.
-

(ICRAF. RUPES Sumberjaya Brief No. 2)

Characteristics of PES Mechanism

Voluntary - Both conditional land tenure and RiverCare reward mechanism are voluntary. People do not have to join the RiverCare group and HKm groups. However, in both cases non-participants are likely to face pressure from participants if they resort to land use management that adversely affects environmental services. During focus group discussions, members of the HKm groups said they may have to move out of the area if they did not join the group (Sumberjaya farmers, personal communication, May 2007).

Conditionality - Both PES mechanisms also tend to meet the conditionality test. Community forestry permits will be renewed beyond 5 years only if forest groups comply with stated conditions. There are two weak points in this mechanism. First, as Kerr et al (2006) argue once the permit is extended for a period of 25 years, community groups may have little incentive to adhere to conditions. However, members of HKm groups indicated that they intend to comply with the conditions and they understood that they would be penalized if they violated conditions. Violators would also face pressures from other members of the group. Some groups suggested that they would expel members from their group if they did not adhere to conditionality (focus group discussions with five HKm groups, May 23, 2007) Second, this mechanism is based on ICRAF's research that multi-strata coffee based agro-forestry leads to beneficial environmental services. There is no mechanism to quantitatively determine whether multi-strata coffee based agro-forestry actually increases water yield and quality. Conditionality is well specified in RiverCare mechanism but this mechanism is still in an experimental stage.

Active Involvement of Buyers: The conditional land tenure mechanism under Hutan Kamasyarakatan (HKm) program evolved out of a pressing need of the government's forest department to solve recurring illegal encroachment of protected forest area and conflicts with local communities. The government felt it had to do something new to protect the watershed as its policy of forcefully keeping farmers away was not working.

[29] Recently, the government has extended the HKm permits from 25 to 35 years (discussions with HKm group members in Sumberjaya during May 2007 field visit).

Lessons from Sumberjaya for Designing New PES Mechanisms

Role of Research Organizations: ICRAF's research findings that multi-strata coffee based agro-forestry system is as good as natural forests in supplying environmental services played a crucial role in initiating conditional land tenure mechanism (Arifin, 2005)

Role of NGOs and other organizations: For both conditional land tenure and RiverCare mechanisms, farmers needed to be organized into groups. The role of local and international non-governmental organizations was important in forming these groups. These organizations also helped in linking community groups with the Forestry Department. Donor organizations such as the Ford Foundation and the International Fund for Agricultural Development (IFAD) played important roles in supporting the efforts of ICRAF and local non-governmental organizations.

Laws and Regulations: Favorable laws and regulations are needed for the emergence of sustainable PES mechanisms. In Sumberjaya, the passage of social forestry or HKm regulation created an opportunity to use conditional land tenure as a potential reward mechanism for environmental services.

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Paying for Watershed Services in Latin America: A Review of Current Initiatives

Authors:

Douglas Southgate, Sven Wunder

Prepared by:

Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program (SANREM CRSP)

Office of International Research, Education, and Development (OIRED), Virginia Tech

E-mail: oired@vt.edu
On the Web: www.oired.vt.edu

July 19, 2007

Acknowledgments:

Douglas Southgate*, Ohio State University, Columbus, Ohio
southgate.1@osu.edu

Sven Wunder, Center for International Forestry Research, Belém, Brazil
s.wunder@cgiar.org

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Regional Review of Payments for Watershed Services in Latin America

1. Introduction

In various settings, compensation is provided to resource users who volunteer to follow management guidelines. One example is the Conservation Reserve Program (CRP), in which U.S. farmers are paid for taking environmentally sensitive land out of production. Likewise, payments for environmental services (PES) are being harnessed for the sake of watershed conservation in Latin America and other developing regions.

Considerable enthusiasm has been expressed for PES from a conceptual point of view. For example, Simpson and Sedjo (1996) have highlighted the advantages of direct conservation payments over integrated conservation and development projects, which environmental groups and international development agencies favored from the late 1980s through the 1990s. The same advantages have been stressed in other writings (Ferraro, 2001; Ferraro and Kiss, 2002; Ferraro and Simpson, 2001). In a highly influential contribution to the literature, Rice *et al*. (2001) made the case that direct payments to forest dwellers are more effective than trying to promote sustainable, selective logging, which has been a feature of many integrated conservation and development projects.

Quite a lot has been written recently about PES as a tool for watershed conservation. The general approach is to compensate people in the upper reaches of drainage basins who refrain from land uses that exacerbate flooding, periodic water shortages, water quality problems and other problems at lower elevations (Landell-Mills and Porras, 2001, Pagiola, 2002). Full-fledged examples of this approach, however, remain few and far between (Robertson and Wunder, 2005).

This paper addresses the challenge of using PES to enhance hydrologic services in Latin America. To begin, the current state of implementation is described. We are able to identify just a few sites where each and every feature of PES is in place and many places where some but not all these features have been adopted. In the latter part of the paper, we examine why PES implementation remains incipient in Latin America, albeit farther along than in other parts of the developing world. Our analysis focuses on public policy, institutional factors, and political realities affecting PES in Latin America.

2. Conservation Payments and Their Use in Latin America

Although economists often have pointed out the merits of conservation payments that are direct and contractual, a precise and commonly accepted definition of PES has proven elusive. Attempting to provide such a definition, Wunder (2007) describes PES in terms of five characteristics.

1. There is a **well-defined** environmental service (e.g., specific changes in peak- or dry-season stream flow at the outlet of a watershed) or a suitable proxy for this service (e.g., hectares reforested).
2. There is at least one **buyer** of this service or proxy.
3. There is at least one **seller** as well.
4. Transactions between buyer(s) and seller(s) are **voluntary**.
5. Payments are **conditional** on contracted environmental services or proxies for same actually being supplied.

Arrangements featuring all five of the preceding characteristics turn out to be rare in the Americas, even though the total number of PES or PES-like schemes (which satisfy most but not all of the five criteria) clearly exceeds numbers in Africa and Asia. One reason why conservation payments have been accepted a little more readily in Latin America appears to be that rural land tenure tends to be more secure in the region, in terms of de facto control over resources (be these private or communal properties). Without this control, users and owners of natural resources are in no position to be reliable

suppliers of environmental services.[30] Another reason is that commercializing rights to land use and land management practices is culturally and politically acceptable in much of the region. Major exceptions include parts of the Andes with large indigenous populations as well as Venezuela.

Among various stock-taking assessments of PES schemes, the most frequently cited is by the International Institute for Environment and Development (IIED) (Landell-Mills and Porras (2002). IIED is currently updating its survey of watershed-focused schemes.[31] While such overviews provide a broad vision of existing initiatives, they cannot substitute for primary field evaluation. National-level PES appraisals have been carried out by the Center for International Forestry Research (CIFOR) and its partners for Bolivia (Robertson and Wunder, 2005), Colombia (Blanco *et al*., 2005), Venezuela (Blanco *et al*., 2006), and Vietnam (Wunder *et al*., 2005). A major finding of these appraisals is that many PES initiatives have not actually gotten off the ground. Some remained in the planning stage.[32] Others were abandoned before implementation.[33]

Among the active projects identified in the IIED assessment, many have selected "PES-like" features yet still differ markedly in design and impacts from a complete PES scheme, as defined in this paper. For instance, various debt-for-nature swaps are included. Other assessments for the region include schemes in which local people are employed as forest rangers for protected areas, as opposed to being paid for an environmental service (Veen, 2007). There are also initiatives that function like a PES on the buyer's side, with service-users being charged, but without conditional payments to service-providers. This is the case with FONAG in Quito, Ecuador, which is the subject of one of the three case studies accompanying this paper, as well as payments by irrigators in Colombia's Cauca Valley.

The fact that these last two initiatives are frequently cited as standard cases in the PES underscores two lessons. One is the need to be cautious about what is labeled as PES. The other is the value of primary surveys, of the sort carried under CIFOR's auspices. An appendix to this paper contains a partial list of 90 Latin American projects with PES characteristics. Commentary follows about payments schemes undertaken for watershed conservation and other purposes in two parts of the region, the Andes and the Amazon, with which this paper's authors are familiar. Broader geographic coverage is accomplished by including a case study of Mexico's program for environmental-service payments and a box-description of the pioneer national PES scheme in Costa Rica.

The Andes. Due to increasing water scarcity and upstream forest loss, there is a high potential for watershed PES in many parts of the Andes, where mountainous topography coincides in many places with large numbers of water consumers. Nevertheless, receptiveness towards conservation payments varies. While some places are fairly open to market-based incentives for water management, others are not. Resistance sometimes has to do with a history of resource usurpation. In addition, some people cannot reconcile the fact that water satisfies basic human needs with the reality that hydrologic resources are growing scarcer and hence more marketable – or even that channeling water from its sources to the places where it is consumed is not free, and therefore must be financed either by consumers or others. In societies with a strong indigenous culture (e.g., the Bolivian highlands), PES development tends to lag. The same holds for large, closed economies, such as Venezuela.

Incentives are strong in **Bolivia** to protect watersheds as well as the amenity resources harnessed for ecotourism. However, skepticism is widespread toward the "neoliberal" approach to natural resource management, generally, and PES, specifically. Related to this are suspicions of disguised privatization of public-access resources, including water. Furthermore, key preconditions for PES, such as secure land tenure, are still lacking in many places. As a result, most conservation initiatives are properly categorized

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[30] This being said, many parts of Latin America are traversed by active agricultural frontiers. PES implementation is a considerable challenge in these settings, precisely because resource tenure is tenuous.

[31] The authors of this updated survey have kindly shared a preliminary draft with S. Wunder, cited in this paper as "Ina Porras and Nanette Neves, personal communication, September 2007.

[32] One of these is the national CIF watershed conservation program in Colombia.

[33] The Bermejo River watershed protection scheme in Bolivia is a case in point.

as traditional projects. Among the few genuine PES pioneers in Bolivia is a small scheme administered by Fundación Natura, a national NGO, in the buffer zone of Amboró National Park, where irrigator and biodiversity payments are pooled to finance conservation (Asquith *et al*., forthcoming). Opportunities to use the same approach are more promising in the Andean foothills and the transition to Bolivia's lowlands (*Media Luna*), where there is less ideological resistance to economic instruments and where irrigated, commercial agriculture and urban water consumers comprise potential buyers. Various municipalities in Tarija and Santa Cruz are also experimenting with PES-like watershed schemes (Robertson and Wunder, 2005).

In terms of water scarcity, management benefits, and numbers of water consumers, the potential for watershed PES is as large in **Peru** as elsewhere in the Andes. But so far, experimentation with PES has been less in Peru than in Bolivia. No projects for carbon sequestration appear to be running, although some are under preparation. As for watershed schemes, the most serious efforts have been in Alto Mayo-Moyobamba, San Martín department, and in the Jequelepeque and Piura watersheds, where German GTZ and CONDESAN have been working together in the Andean Watersheds Project (Veen, 2007). While negotiation processes have advanced noticeably, a primary obstacle has been to transform willingness-to-pay on the part of potential service buyers into actual monetary flows (A. Moreno-Díaz, personal communication, January 2007).

At present, no South American nation has a richer PES portfolio than **Ecuador**, where ideological hostility to conservation payments is less than in Bolivia and Peru. Two pioneer schemes that fit the five-point PES definition completely have been running for years. One is the PROFAFOR carbon sequestration program, which has been operating for a decade (Albán and Argüello, 2002). The other is the Pimampiro municipal watershed scheme, which is the subject of one of our case studies. These forerunners have inspired a new generation of local, self-organized PES schemes, including a municipal watershed project in Celica (Loja Province). Another type of scheme draws on water funds to which customers contribute to finance watershed conservation. However, these funds, which have been established in Quito, Cuenca, and El Angel, finance conservation projects rather than being used to compensate private providers of environmental services.

Colombia is probably the most advanced Latin American country in terms of creating innovative mechanisms for the financing of conservation. But while charging users of environmental services has become widespread in the country, compensating service-providers on the ground is less advanced than in Ecuador. Most monies go to traditional project activities, studies, and administration. A national program for the protection of critical watersheds, inspired in part by a similar program in Costa Rica (see Box), was designed a few years ago. However, the *CIF de Conservación* was never implemented due to lack of funds. The *Familias Guardabosques* is another national payments scheme, but has no real environmental conditionality and therefore reduces to a program for eradicating coca bushes (Blanco *et al*., 2005). One full-fledged PES scheme is a silvo-pastoral initiative for biodiversity and carbon enrichment financed by GEF (Pagiola 2004), which one of the project partners (CIPAV) currently plans to extend to watershed management. Watershed experiences include a water-fund irrigator scheme in the Cauca Valley, which does not make use of direct compensation for service-providers. Significant PES potential seems to exist at the provincial (*corporación*) level, where the bulk of environmental finance is administered (Blanco *et al*., 2005).

No genuine PES or PES-like schemes exist at present in **Venezuela**. However, a hitherto under-utilized national program (*Subsidio Conservacionista*) constitutes a potential legal framework for the approach. Furthermore, increasing demands for environmental services, especially for watershed protection, create a large potential for (and local-level interest in) PES. In some of the six sites examined during a recent field assessment (Blanco *et al*., 2006), conservation payments seemed feasible if the willingness-to-pay of service users could be captured. In fact, due to a high degree of urbanization in Venezuela, the ratio of potential providers (i.e., upstream landowners) to potential beneficiaries (including urban consumers of water and hydropower as well as irrigated agriculture) is low, which favors PES. In one part of the Andes – the Pereña and La Jabonosa watersheds, which are the source of drinking water for the western part of Táchira state – consumers are already paying a minor management fee, equal to 0.5

percent of their water bills, and the public water utility company is now planning to make compensation payments on a trial basis (Blanco *et al*., 2006). Unlike in Ecuador, though, true PES in this and other cases may only be achieved with close participation of the central state.

In summary, PES development in the Andean region is uneven, with Ecuador and Colombia more advanced than Bolivia, Peru, and Venezuela. Some of this variation traces to political-ideological factors. Watershed services clearly dominate other services and demand for the former is on the rise. Other than some trial initiatives in Colombia, all existing schemes are self-organized by buyers, sellers, and intermediaries, with little involvement by the central state. Basically all schemes are bilaterally negotiated deals – not quite markets in which environmental services are bought and sold continuously.

The Amazon and Brazil. Fed mainly by major watercourses flowing out of the Andes, the Amazon is the world's most voluminous river, with average discharge at its mouth exceeding normal flow from the Mississippi River into the Gulf of Mexico by an order of magnitude. Furthermore, the largest continuous rainforest on Earth lies in and around the river's drainage basin. This ecosystem performs multiple environmental functions, some of global significance.

PES activity has occurred in the Amazon. For instance, payments have been collected from tourism operators in Peru's Madre de Dios region to finance the conservation of scenic vistas (Veen, 2007). A similar scheme exists in Bolivia's Madidi National Park, which is one of the world's most biodiverse protected areas (Robertson and Wunder, 2005). However, the specific mechanics of these initiatives differ from those of a pure PES (Ferraro and Simpson, 2005). Much debated has been a trial of conservation concessions in an extremely remote and sparsely populated part of Guyana, undertaken by Conservation International (Hardner and Rice, 2002).

With broad stretches of cheap land available for tree-regeneration, the Amazon and adjacent territories are attractive settings for carbon-sequestration initiatives. Illustrative in this regard is a project underwritten by Peugeot, the French auto-maker, to establish forests on 5,000 hectares of degraded pastures in Mato Grosso state. Another Brazilian example is the Ilha de Bananal "social carbon" initiative, designed to arrest deforestation in the Cerrado transition zone (May *et al*., 2004). Particularly well known is Bolivia's Noel Kempff Mercado Climate Action Project, in which a national park with elevated biodiversity as well as huge volumes of standing timber has been extended by 634,000 hectares to put a brake on logging and agricultural colonization (Asquith *et al*., 2002; May *et al*., 2004; Robertson and Wunder, 2005). Additional PES activity of this sort is to be expected, given that interest is growing in arresting deforestation so as to curb carbon emissions and to safeguard species-rich ecosystems.

However, there is much less interest in the Amazon in PES with a hydrologic purpose. One economic reason for this is that water is abundant in the region. Moreover, improved resource management at higher elevations has very little effect on the quantity or quality of water downstream. Even the impacts of conservation on peak run-off during or right after storms tend to be small at the scale of a large drainage basin (Chomitz and Kumari, 1998).

Paired with abundant supplies of water in the Amazon Basin are limited demands for the resource. Outside of a few large cities, such as Iquitos, Peru and Manaus and Belém in Brazil, just a few million people live in the continent-sized area that would benefit (modestly) from watershed conservation. Hydroelectric projects, some of major dimensions, have been developed in the Brazilian Amazon. But the flat topography, which results in extremely large reservoirs, reduces the impacts of sedimentation i and the benefits of arresting sedimentation are probably not significant.

Some hydrologic services are potentially important in the Amazon. For example, it has been hypothesized that continued deforestation in the region could have a noticeable effect on climate in other parts of Brazil and perhaps even in the wider region. However, these effects have not been demonstrated conclusively enough to trigger willingness-to-pay for forest protection.

Finally, there are instances in which economic interests in the region are harmed by environmental deterioration, although institutional conditions impede PES. A case in point is the harm done to freshwater fisheries because of logging and deforestation. While scientists have presented convincing evidence of this harm, little if anything is done about the problem. One reason is that small

fishermen, who stand to capture many of the gains from ecosystem protection, are socially minor and poorly organized, which reduces the political influence they might exert to establish conservation payments or some other environmental measure. Also, fisheries are an open-access resource, which means that free-riding among the beneficiaries of conservation tends to interfere with the effectiveness of a conservation tool like PES – as is explained later in this paper.

The Brazilian government has launched the Proambiente program, in which payments are used to promote environmental sustainability in the Amazon. Groups of farmers are contracting to follow land-use plans that feature restrictions (e.g. no clear-cutting or burning), which augment environmental services, including watershed protection in principle. In return, they receive payments from the central government. The program has had a long preparation phase and was led by movements representing the rural poor, rather than being created to satisfy demands for environmental services. Certain pilot areas in the Amazon were selected for application, and in 2006 the first set of payments were made. However, the program depends entirely on the general government budget – as opposed to an earmarked tax (such as the fuel tax in Costa Rica – see Box) or contributions from parties outside of government who value environmental services (e.g., buyers of carbon credits). For this reason, Proambiente's financial outlook is not encouraging. This highlights an important advantage of PES, which is to organize service-buyers and other advocates for conservation with some sort of political presence.

In other parts of Brazil, carbon initiatives have been implemented. For instance, the Plantar project, financed by the World Bank's Prototype Carbon Fund, aims to provide economic incentives for sustainable wood supplies for pig iron production in Minas Gerais state (May *et al*., 2004). Several cities in the southern part of the country have shown interest in PES or PES-like schemes for the sake of watershed conservation. One of these is the "Ecological Value Added Tax (VAT)," which was implemented first in Paraná and later in other states (Grieg-Gran, 2000; May *et al*., 2002).

This arrangement comprises a departure from normal practice, in which VAT revenues are allocated according to levels of economic activity. Since local jurisdictions with extensive forests and other natural vegetation normally receive lower revenues, conservation is discouraged. In contrast, the Ecological VAT takes into account both the size and quality of natural assets, with particular emphasis given to watershed and recreational benefits that are measured by environmental indices. Clearly, the alternative arrangement adds to conservation funding and is also conditional. However, it mainly serves to alter the allocation of government monies to projects undertaken by the public sector, with very little compensation provided to private-sector providers of public services. For this reason, the Ecological VAT is properly classified as borderline-PES.

3. Analyzing the Challenge of PES Implementation

It is a considerable leap from pointing out the general advantages of direct conservation payments to full implementation of PES, which involves the recruitment of voluntary participants on both the demand side and the supply side of a market for a well-defined environmental service – a set-up, furthermore, in which everyone involved understands that payments are conditional. Little wonder, then, that discussions of this alternative in Latin America revolved for many years around the experience of Pimampiro, Ecuador. Thanks to outside support, this small, Andean community and its watershed were just about the only setting in the region where all five elements of PES had been put in place (Echavarría *et al*., 2002; Wunder and Albán, forthcoming).

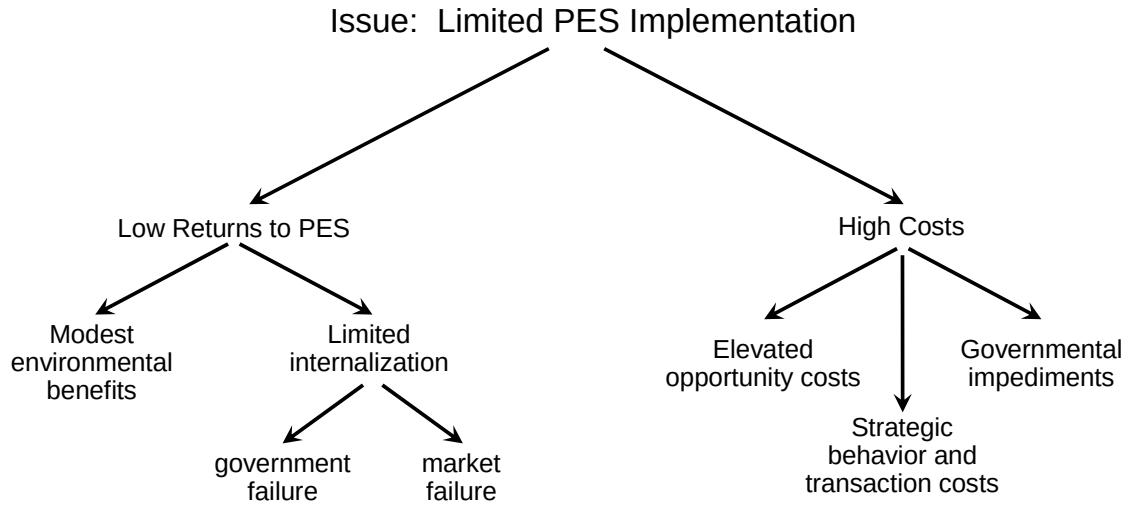
As documented in the preceding section, conservation payments are used somewhat in the Andes and sparingly in Brazil. Elsewhere in Latin America, a program of national scope exists in Mexico (see Case Study 3). Also, PES implementation is far advanced in Costa Rica (see Box) and other parts of Central America. In contrast, there is little evidence of this approach so far in other places, including in Chile.[34] This is surprising not only because the country depends heavily on managing water resources

[34] At the Ecosystem Services Conference held in Valdivia, Chile in November 2006, considerable interest was expressed in PES, although there were no watershed-level applications of the approach were presented. One

well, but also because its tradition of strong property rights and pro-market economic policies is harmonic with PES.

To understand why conservation payments are not used more widely in Latin America, we adapt from a general framework for distinguishing among and analyzing basic obstacles to economic development, broadly defined (Hausmann, Rodrik, and Velasco, 2005, cited in Rodrik, 2006). As represented in Figure 1's flow-chart, the first diagnostic step involves evaluating two fundamental reasons for the limited use of PES. One of these is low benefits. The other reason is high costs.

Figure 1: Diagnosing the Challenge of PES Implementation



As also shown in Figure 1, the returns to PES can be modest because environmental benefits are limited (perhaps for geographical reasons), these benefits are difficult for economic agents to internalize (because of government or market failure), or perhaps both. Likewise, the costs of PES implementation are influenced by various factors. One of these, which obviously influences compensation levels, is the opportunity cost of resources that payment-recipients are asked to give up, at least for a while, so that environmental services can be produced instead. Investigation of the cost side of PES implementation also involves accounting for strategic behavior and transaction costs, both of which tend to proliferate as numbers of resource users and stakeholders rise, as well as looking at ways that the public sector makes PES implementation more difficult, not less so.

We now consider, in order, the benefits and costs of PES, as is needed to explain current adoption of this approach in Latin America as well as the future prospects for PES in the region.

Modest environmental benefits. For nearly as long as watershed conservation initiatives have targeted small farmers and others in the upper reaches of drainage basins, who are the main recipients of PES, doubts have been expressed about the environmental benefits of these initiatives. One criticism, made by Hamilton and King (1983) and others, is that natural (or background) variability in environmental parameters often outweighs the impacts that upper-watershed inhabitants have on the environment. Further complicating the issue is that the scientific uncertainty over the relationships between land management and environmental impacts is often considerable. The displacement and transport of sediments comprise a case in point. Where land formations are of recent geological origins, with steep slopes and poorly consolidated soils, natural erosion in drainageways and stream channels is

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possible reason for this is that foreign donors and development agencies play less of a role in the country than in other parts of Latin America.

often substantial, particular after heavy, tropical downpours. Expensive to control and difficult to estimate, this natural erosion can easily dwarf the volumes of soil lost from small farms. One area where this is the case is the mountainous watershed upstream from Ecuador's largest hydroelectric facility, in the southern part of the country (Southgate and Macke, 1989).

Likewise, water yield is an environmental service that, as a rule, is influenced more by precipitation and other natural conditions on an annual basis than by the number of trees that small farmers and other PES recipients may or may not save or plant. Once again, scientific uncertainty on cause and effect relationships is considerable. For example, newly planted trees often consume more water than other vegetation, which can actually diminish the availability of hydrologic resources for other uses. On the other hand, a maturing forest improves soil function, such as infiltration, which can enhance water yield during the dry season and diminish runoff during and right after downpours. Less uncertain are the hydrologic benefits of conserving cloud forests, since the loss of this habitat can reduce fog-capture (or horizontal precipitation) noticeably. This impact has been demonstrated at selected sites in Central America and the Andes, although significant scientific uncertainties remain over these relationships. Moreover, the lack of reliable methods for rapid assessment means that determining the hydrologic benefits of preserving cloud forests is often a challenge – at times, more expensive than payments to upstream farmers required to preserve that habitat, as demonstrated in a Bolivian watershed (Asquith *et al*., forthcoming).

Hamilton and King (1983) also observe that upper-watershed inhabitants are not always the most important human agents of environmental change. To the contrary, road-building, sand and gravel mining, and other large-scale activities, which usually are not the target of PES schemes, are frequently more important causes of watershed deterioration than small-scale farming. The aforementioned hydroelectric watershed in southern Ecuador is illustrative in this regard (Southgate and Macke, 1989).

To summarize, the expected environmental benefits of direct conservation payments to people in the upper reaches of drainage basins may be obscured by natural environmental variability, spotty scientific evidence about the hydrologic consequences of land-use change, risks of non-compliance on the part of providers, and the impacts of human activities not normally targeted by PES initiatives. Alone, these obstacles may not jeopardize PES implementation. That is, service-users may be willing to address some (as opposed to all) problems in a watershed and to accept that the probability of success is less than 100 percent. However, these obstacles can be very debilitating when combined with appropriation problems, to which we now turn.

Limited internalization. Even if the environmental benefits of PES are potentially sizable, the returns to a payments scheme may be reduced, because market failure or government failure cause benefits not to be internalized – or, to use terms generally regarded as interchangeable, captured or appropriated.

Market failure can diminish the internalized returns of PES in various ways. For instance, safeguarding ecosystems in upper watersheds may create multiple environmental services, only some of which interest buyers in a PES scheme. A representative case would be for the hydrologic impacts of habitat conservation to be valued and paid for, but not the effects on biodiversity or carbon sequestration. Potential buyers of the latter services may choose not to offer payments due to lack of information, high transaction costs, or incentives to free-ride on the party or parties paying for watershed conservation. If so, non-watershed values comprise externalities. Too little money may be collected and conservation payments may achieve a sub-optimal level of ecosystem conservation.

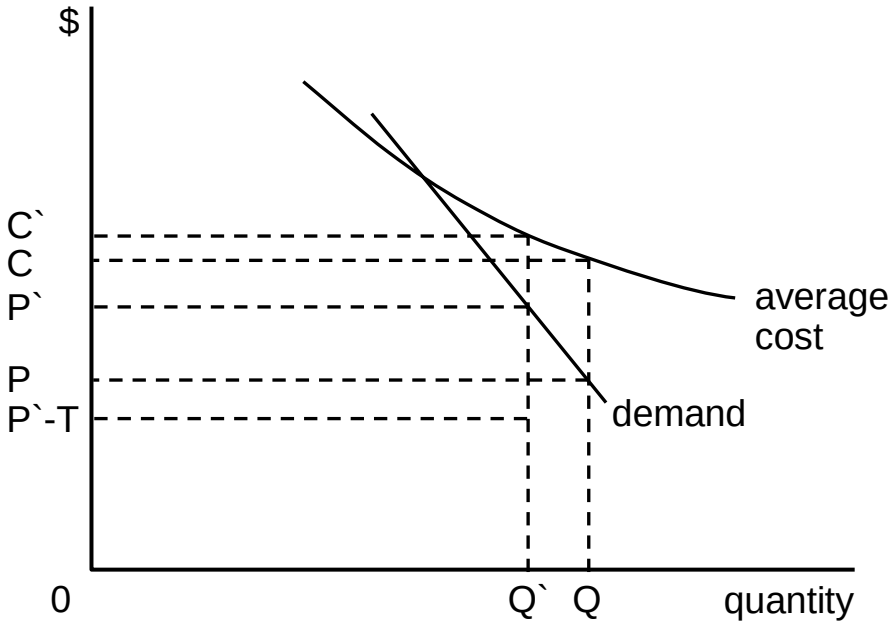
Market failure can also arise in a setting where conservation of a single area of hydrologic importance improves water supplies in two or more downstream communities. One or more of these communities might free-ride, counting on the others to finance the protection of the water source on their own. In the face of this strategic behavior, which causes some watershed values not to be captured, overall funding may be insufficient to achieve the desired hydrologic services. Conceivably, communities considering paying for environmental services might conclude that doing so is not

worthwhile, particularly if there are no institutional arrangements for securing the collective action necessary to compel payment from all beneficiaries.

Aside from market failure, government failure can diminish the appropriation of environmental benefits, thereby making PES less attractive. This is certainly a possibility where potable water is sold for less than its cost – a policy that used to be widespread in Latin America and which continues to be applied in a number of settings.

Consider the impacts of conservation payments if the revenues that a municipal water company collects from its customers in the absence of PES are less than the combined expenses of amortizing, operating, and maintaining its pipe network, pumping stations, and other infrastructure. The unrecovered portion of these expenses is represented in Figure 2 by the rectangular area, (C - P) x Q, where C represents the average amortization, operation, and maintenance cost of delivering water (Q) to the company's customers and P is the subsidized price paid by these consumers. The demand curve's negative slope indicates that consumption goes down as the price goes up, *ceteris paribus*. The average-cost curve also slopes downward, which reflects the fact that delivering water throughout a single city is a natural monopoly.[35]

Figure 2: PES, Price Subsidies, and Natural Monopoly



Suppose a conservation payment is instituted, equal to T on each unit of water sold. As far as consumers are concerned, the price of water has risen, which causes them to cut back on purchases. At the higher price, P' (which includes T), consumption is lower, Q'. Significantly, the unrecovered portion of amortization, operation, and maintenance costs goes up. One reason for this is that, provided demand is not perfectly inelastic (as would be indicated by a perfectly vertical demand curve), the revenue received by the supplying company for each unit of water it sells – P' minus the conservation payment – is lower than per-unit revenue in the absence of PES, which is P. At the same time, average cost goes up, to C',

[35] With natural monopoly, efficiency requires that price be less than average cost. That is, the efficient price equals marginal cost, which is less than average cost as long as the latter is declining. However, water subsidies in Latin America rarely if ever are driven by a desire to achieve efficiency. Rather, the main motivation is simply to benefit consuming households, especially those with political influence.

because supplying water is a natural monopoly. Between these two impacts, the unrecovered segment of amortization, operation, and maintenance costs with PES – (C' - [P' - T]) x Q' – almost certainly exceeds the unrecovered segment of these costs without PES – (C - P) x Q.

The economic circumstances depicted in Figure 2 elucidate the opposition to PES that can arise within a municipal water company. If water consumption is negatively related to price and if supplying water is a natural monopoly, increasing its price and locking in a portion of revenues for environmental protection, which is exactly what conservation payments are supposed to accomplish, can add to the challenge of meeting other costs, which as already mentioned are not fully recovered in many places even without PES. This problem helps to explain why some professional staffers in the municipal water company of Quito, Ecuador have been less than enthusiastic about including environmental payments in customers' bills and dedicating these payments to watershed conservation and related activities (see Case Study 2). For these opponents, PES complicates the task of paying for amortization and operations and maintenance.

Elevated opportunity Costs. Even if environmental benefits are both sizable and readily appropriated, a conservation initiative may fail because of high costs. One factor that can drive up costs is the need to protect critical areas against damage by third parties, by putting in a fence (to keep cattle out) or a fire break for instance.

Uniquely, PES costs include payments made to households that supply environmental services, payments which are influenced by farming practices and earnings and other elements of household-level survival strategies. Some small-scale farmers in Latin America may use land more productively than operators of large-scale *haciendas*, which causes them to demand more compensation per hectare before taking part of their land out of production or agreeing not to deforest part or all of their holdings. In contrast, some subsistence producers may settle for lower payments, if the additional cash relaxes the financial constraint on seeking alternative off-farm employment.

Household-level risk, which is a major concern in rural areas throughout the developing world, has important consequences for PES. One possibility applies to people who engage solely in farming. For them, receiving a reliable payment makes overall income, which otherwise consists entirely of the varying returns to agriculture, less variable. Depending on how risk-averse they are, these people may accept modest payments in return for adopting conservation measures.

In contrast, the appeal of PES to the many households in the Latin American countryside that have diversified their sources of income may be more qualified. In El Salvador, for example, much of the rural population has risen out of poverty by starting micro-enterprises or finding non-agricultural work. Nevertheless, they do not abandon farming entirely, mainly because growing some of one's own food is a way to deal with the downside risks of off-farm employment (Rodríguez-Meza, Southgate, and González-Vega, 2004; González-Vega *et al*., 2004). Clearly, any payments directed toward such households would need to reflect the de facto insurance value of resources that provide nourishment when off-farm employment and earnings ebb, particularly if payment-recipients pay a heavy penalty for abrogating PES contracts.

An empirical study carried out in the vicinity of Quito, Ecuador provides evidence that the receptiveness of rural people to conservation payments is influenced by their sources of income, which feature varying levels of risk.[36] The study site was a rural community, Cangahua, located in the same Andean drainage basin as the capital city. Moreover, Cangahua is representative of the places where PES are being implemented or proposed in order to safeguard water supplies.

Approximately, 200 rural households in Cangahua were surveyed in early 2004, with agricultural, economic, demographic, and other data being collected. The questionnaire included a contingent-valuation (CV) question, which was designed to elicit the minimum payments that households would demand in return for taking erosion-prone land out of production for five years. Among the findings of

[36] This research was supported financially by the Sustainable Agriculture and Natural Resource Management Cooperative Research Support Program (SANREM-CRSP).

econometric analysis of responses to this question was that respondents engaged primarily in subsistence farming are willing to accept relatively modest payments, because PES represent an attractive alternative to the modest and varying returns from subsistence agriculture. In contrast, the compensation demanded by households that have succeeded in diversifying their income sources is considerably higher, evidently because such households place great value on their access to resources that can be harnessed in a pinch for subsistence food production (Southgate, Haab, and Rodríguez, 2005).

To determine PES compensation levels, the standard practice has been to take a somewhat narrow view of the opportunity cost of resources that payment-recipients are currently using and are being asked to give up (for a while). That is, opportunity cost is defined and measured, simply, as the expected market value of agricultural and other output that a payment-recipient must sacrifice. Research of the sort undertaken in Cangahua raises the possibility that this approach yields estimates that are too high in the case of subsistence farmers. At the same time, narrow calculations of opportunity costs can understate the minimum payment demanded by someone with diversified earnings. This is because such calculations do not take into account how households deal with risk, such as maintaining the option of using land for subsistence production during hard times.

Strategic behavior and transaction costs. Aside from reflecting all values that PES recipients place on land they are being asked to take out of production or manage differently, payments can be driven up by strategic behavior on their part, transaction costs, or both. Strategic behavior can arise whenever a fundamental efficiency-criterion for PES is satisfied: the downstream value of watershed services provided by multiple suppliers exceeds the combined payments required to produce these services. Under these circumstances, an individual supplier might engage in holding out, in the hope of capturing more of the net benefits of watershed services – that is, the difference between downstream benefits and upstream costs (including conservation payments). If there are several hold-outs, then the entire deal between upstream providers and downstream beneficiaries of watershed services might collapse.

Strategic behavior of this kind can be contained. One option is to implement the sort of bidding procedure proposed by economist William Vickery, a Nobel laureate. The unique feature of a Vickery auction is that winning bidders do not pay or receive the price they named, but instead the amount offered by competitors whom they have edged out (Kagel, 1995). In the case of watershed PES, people whose offers to conserve land have been accepted receive compensation a little above what they have proposed. This arrangement discourages exaggerated bids, as hold-outs submit, since the main consequence of exaggeration is to increase the payment received by someone else.

The existence of mechanisms such as Vickery auctions means that strategic behavior need not interfere with PES adoption. If direct payments are truly a good way to finance watershed management, because conservation costs are exceeded by downstream benefits, then the problem of hold-outs can be contained. By the same token, free-riding, which interferes with the internalization of environmental values (see above), can be kept in check by designing markets properly.

Also difficult to contain in many settings are transaction costs, which relate to negotiating contracts with the providers of environmental services, monitoring compliance with these contracts, and related tasks. In Pimampiro (Case Study 1), payments from water consumers, who benefit from watershed conservation, are sufficient to finance all compensation received by providers of environmental services, which varies from US$6 to US$12 per hectare per annum, as well as recurring transaction costs, which are estimated to be US$1.57 per hectare per annum (Wunder and Albán, forthcoming). However, a grant of US$37,000 from foreign donors was needed to cover start-up expenditures on background studies, negotiations, and development of a contracting and monitoring system (CEDERENA, 2002).

Transaction costs, start-up as well as recurring, cannot be avoided if the criterion of conditionality is to be satisfied and can be a major barrier to extending the sort of scheme that Pimampiro has pioneered to other places, within and beyond Ecuador.

Governmental impediments. One reason why transaction costs are sizable, especially for small communities, is that increasing returns to scale[37] are a fundamental characteristic of monitoring, which requires remote-sensing capacity and trained personnel for tracking and ground-truthing resource use by payment-recipients. Pimampiro has been able to attract external grants to cover the initial investment in technological capacity and human resources because its PES program has been experimental and path-breaking. If the program is to be replicated elsewhere without such grants, however, one of two things must happen. One option is to change technology in ways that reduce the costs of monitoring at a small scale. The other option, which makes particular sense if increasing returns to scale continue to be a feature of monitoring, is for national governments to provide monitoring and related support, thereby allowing scale economies to be exploited. The idea here is not for the central authority to provide subsidies. Instead, a national agency, which would purchase machinery and software and would hire qualified personnel, would offer its services at a price reflecting its costs, which would be lower than expenses facing a small jurisdiction trying to monitor PES deals on its own.

Lamentably, the governments of Ecuador and other Latin American nations are at present unprepared to make this contribution. One reason for this is revealed by an analysis of Ecuadorian laws relating to PES. Virtually all these legal arrangements focus on the central government's ownership of biodiversity and other resources, obviously anticipating sizable international payments for access to these environmental assets. In contrast, existing laws and regulations are silent on the support that the national state could provide to local PES schemes (Corral and Rodríguez, 2006). As a result, the use of PES in watershed conservation remains excessively expensive, and therefore not resorted to as often as it can or should be.

There is an irony here, given the interest that the national state has expressed in biodiversity conservation. Many of the habitats protected by local watershed initiatives, such as Pimampiro's, are species-rich. The central state's failure to support such initiatives by bringing down transaction costs actually diminishes Ecuador's diverse living resources.

4. Summary and Conclusions

Accurate appraisal of PES implementation requires detailed observation at the field level, mainly to distinguish between schemes with all five characteristics of this approach and those with some though not all these characteristics. Drawing on a handful of assessments in which appraisal of this sort has been carried out as well as our own knowledge of selected nations, we conclude that the PES implementation in Latin America is similar to the state of implementation elsewhere in the developing world. That is, most initiatives currently in operation are "PES-like," not full-fledged examples of the approach. Of the majority, many schemes have failed to cultivate buyers of environmental services, relying instead on contributions from external donors. Others do not feature conditionality, with implementing agencies shying away from the business-like practice of paying only when services are rendered. This reluctance has to do in part with concerns about disrupting relationships with poor farmers, which suggests that PES development and the alleviation of rural poverty may not be entirely harmonious.

Our report on PES in the Andes, the Amazon, and other parts of the Western Hemisphere as well as our analysis of challenges facing this approach suggest that various things can be done to increase the use of conservation payments. Greater scientific understanding of key hydrologic linkages (e.g., sediment displacement due to natural and human forces) would help. So would the counteraction of strategic behavior, through the use of innovative bidding procedures as well as the development of institutional arrangements conducive to collective action. Government policies, such as selling water below its cost, need to be reformed. At the same time, the public sector needs to help reduce scale-dependent transaction costs, which are especially burdensome for small communities and which counter the capture of society-wide benefits (e.g., biodiversity protection) created by watershed protection at the local level.

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[37] Where returns to scale are increasing, as is the case both with monitoring compliance with PES agreements and with potable-water supply, then per-unit cost declines as the activity in question increases, exactly as is indicated by the downward-sloping average cost curve in Figure 2.

Beyond coming to terms with specific tasks such as these, one must bear in mind broader reasons why there is often a gap between what PES theorists have imagined in scientific articles and the reality of PES on the ground. One of these is that Latin Americans traditionally have made use of the natural environment for free – logging, mining, and expanding the agricultural frontier pretty much as they pleased. In light of this history, actually paying for environmental services, in response to mounting resource scarcity, represents a major change.

In addition, inertia sometimes can constitute a hindrance to the adoption of innovative policies, such as PES. The benefits of this new approach have yet to be conclusively demonstrated, in part because experience with conservation payments is still limited. Also, PES implementation is held back in many places because of mistrust by key stakeholders. For example, service-providers – most notably, small, indigenous farmers – fear that PES represent a first step toward permanent expropriation of their resources. At the same time, service-users might suspect that they are or will be the victims of "environmental blackmail." Intermediaries, including NGOs and civil-society elements, sometimes have the confidence of stakeholders needed to overcome "perceptional obstacles" such as these. The presence of such "fair brokers" between users and providers of environmental services often catalyzes early PES initiatives, which can in turn lead to scaled-up programs such as the Costa Rican PSA or the Mexican PSA-H. Aside from being trustworthy, these intermediaries also need to be willing to invest the time and effort required for effective negotiations.

As such negotiations are pursued, there is no reason to insist always on one-size-fits-all when applying economic incentives in environmental management, with conditionality and all other features of PES in place everywhere. But while customizing schemes to local conditions may be entirely sensible, we are convinced that payment-initiatives in a number of settings would be more effective if these adhered more closely to all five PES principles. For example, when service users do not pay, it is almost impossible to make a PES scheme sustainable, since external sources of support are bound to decline sooner or later. In addition, when there is no strong conditionality, service delivery is compromised in most cases. Following a complete set of guiding PES principles, then, is not just a question of academic grace. Instead, doing so directly affects the functionality of conservation payments.

CASE STUDY 1
PIMAMPIRO, ECUADOR

Located in the Andes of northern Ecuador, the municipality of Pimampiro draws most of the water for its 13,000 inhabitants from the 630-hectare Palahurco watershed. Responding to water shortages and inspired by Costa Rica's PSA program (see Box), the town has used PES to finance the protection and regeneration of natural forests and *páramos* (alpine grasslands) since 2000. Adoption of this approach was made possible by an external grant of US$37,000 to CEDERENA, a local NGO. This grant was used to cover start-up expenses, including those related to background studies, negotiations, and development of a contracting and monitoring system (CEDERENA, 2002).

Recipients of payments all belong to the Nueva América Cooperative. In places more than 3,000 meters above sea level within the watershed, these members had increased livestock pastures and potato fields gradually over time, in addition to occasionally extracting timber. Although no hydrologic studies were carried out before the payments scheme was adopted, the municipal government of Pimampiro reckoned that these activities threatened the quality and seasonal stability of water supplies. Accordingly, PES enrollment for five years was offered to all owners of high-altitude lands, with contracts renewed in early 2006.

Since the program's inception, monthly payments have ranged from US$0.50 per hectare for previously cultivated land that has been allowed to revert to natural vegetation to US$1.00 per hectare for pristine forests and *páramo* (Echavarría *et al*., 2002). Added to this compensation for landowners have been recurring transaction costs for the water company – related to monitoring, administration, and related tasks. These costs amount to US$1.57 per hectare per annum (Wunder and Albán, forthcoming).

Compensation paid to landowners is covered fully by the 1,350 households and businesses in Pimampiro with water meters, which pay a 20-percent surcharge on their monthly bills. Non-paying water users, including irrigators, can be considered free riders. A municipal account with a balance of about US$15,000 comprises a financial guarantee for payments to members of the Nueva América Cooperative who fulfill their contractual obligations (Wunder and Albán, forthcoming).

Pimampiro's program contains the critical feature of PES, which is that payments are conditional. Initially, CEDERENA was responsible for monitoring selected plots of land every three months. This task subsequently passed to the municipal government, which occasionally has lacked the necessary workforce. However, conditionality has been maintained by sanctioning payment-recipients who do not honor land-use agreements. From 2002 through 2004, payments were cut off to several households that were found to be in violation, although some were allowed to reenroll later. Currently, 19 contracts are in effect, representing four-fifths of the Nueva América membership and covering 550 hectares.

Although a few members of the cooperative do not participate in the program, conservation payments that are voluntary and conditional appear to have succeeded in stemming deforestation in the Palahurco watershed. In 2000, prior to the initiation of PES, 198 hectares, equivalent to 31 percent of the watershed, had been cleared for cropland and pasture. Since then, agricultural land use has fallen to 88 hectares, or 14 percent, with a corresponding increase in the area reverting to natural vegetation (A. Guerrero, personal communication, 2005). In addition, timber extraction has all but ceased. These changes contrast markedly with the continuing deforestation that has occurred during the same period in neighboring areas with similar road access and patterns of settlement. Yet to be studied, hydrologic impacts probably have been less pronounced than changes in land use, given that it takes time for watershed functions to recover after soils have been disturbed. But at the very least, the threat of continued degradation has been largely contained (Wunder and Albán, forthcoming).

The Nueva América Cooperative's acceptance of conservation payments, not to mention the impacts of these payments on resource use, might seem anomalous, in particular since monthly compensation of US$0.50 to US$1.00 per hectare is well below the opportunity cost of land (Wunder and Albán, forthcoming). However, individuals are paid for all of their holdings covered by natural vegetation, even though they are capable of clearing only a small share of these holdings in any given

year. The opportunity cost of conservation clearly does not amount to US$0.50 or US$1.00 per hectare, but instead is much higher. In a financial analysis, Quintero *et al*. (2006) found that a household with modest land-clearing capacity and a high discount rate gains by accepting the conservation payment. Interviews with members of the Nueva América Cooperative confirm that household spending has increased thanks to PES (Echavarría *et al*., 2002).

Two caveats must be kept in mind when evaluating watershed services in Palahurco. The first is that, since 2000, Ecuador's liberalization of meat imports has reduced the profitability of ranching, and therefore diminished the rewards of carving new pastures out of forests. In other words, counter-factual (i.e., without-PES) deforestation pressures were reduced. The second caveat, which further complicates definition of the counter-factual scenario, has to do with the effective legal status of forests. To be specific, municipal enforcement of legal prohibitions on logging and land-clearing in the Palahurco watershed, which were promulgated during the 1990s, tightened considerably about the time PES was adopted.

While the value of watershed services might be exaggerated if these two caveats are ignored, there are other environmental benefits that have yet to be analyzed. Among these benefits are biodiversity values, which are appreciable since the Palahurco watershed is part of the buffer zone for the Cayambe-Coca Ecological Reserve – one of the most species-rich protected areas in the world.

The Pimampiro initiative is worthy of the attention it has received because it is one of the few, unambiguous examples of PES, with all five features of this approach in place. There are genuine buyers and sellers of a well-defined (and valid) proxy for an environmental service. Participation is voluntary for both groups. Furthermore, conservation payments are truly conditional. Pimampiro has been a widely disseminated model for small-scale, self-organized watershed PES. For instance, CEDERENA is currently replicating the scheme in Loja province, in the southern Ecuador. A similar initiative in Los Negros (Santa Cruz Department, Bolivia) modeled voluntary agreements to halt upstream deforestation on the contract developed for Pimampiro (Asquith *et al*., forthcoming). What has been put in place in this small, Ecuadorian town thus demonstrates that that it is possible to implement PES in the way economic theorists have devised, at manageable transaction costs and achieving successful and sustainable outcomes. The Pimampiro model is likely to be particularly attractive to other communities searching for novel solutions to difficult watershed problems.

CASE STUDY 2
FONDO PARA LA CONSERVACION DE AGUA (FONAG), QUITO, ECUADOR

Perhaps because of its small size and certainly because front-end transaction costs were covered entirely by external donors, Pimampiro was able to institute full-fledged PES very rapidly. In contrast, implementation of this approach for the benefit of Ecuador's national capital has been gradual. Indeed, the process is still unfolding in spite of its having gotten underway a decade ago.

Though PES implementation is not yet complete, water supply has changed a lot in Quito during the past 20 years. As of the late 1980s, households served by the municipal company, EMAAP-Q, suffered multiple difficulties, including frequent interruptions and low water pressure. Moreover, 35 percent of the metropolitan population, mainly in suburban slums, received no service whatsoever from EMAAP-Q and relied instead on water delivered by tanker trucks, at a high cost (Southgate and Figueroa, 2006). These problems had much to do with prices that public authorities had set well below the expense of delivering water to households and other customers. EMAAP-Q's shaky finances, which were a direct outcome of subsidized pricing, also preempted serious efforts to protect water sources and to deal with pollution.

As the Papallacta Project – which increased metropolitan water supplies by 3 cubic meters per second at a capital cost of US$133 million (Southgate and Whitaker, 1994, pp. 72-73) – was coming on line in 1991, EMAAP-Q was starting to solve interrelated problems of subsidies, unreliable supplies, and entire neighborhoods deprived of service. Cost-recovery improved substantially; by 1995, revenues from water sales were nearly in line with combined expenditures on building, operating, and maintaining pipes, pumping stations, and other infrastructure. Customers accepted price increases without protest because the company used extra funds to improve the quality and reliability of water supplies. In addition, EMAAP-Q's improved financial standing allowed it to extend service to impoverished neighborhoods; by the late 1990s, the share of the metropolitan population lacking a connection to the municipal system had fallen to 10 percent (Southgate and Figueroa, 2006).

The stage was also set to begin dealing with pressing environmental issues. To help build public consensus, The Nature Conservancy (TNC) and its local partners released a widely distributed report – "Water, We Can Take Care of It!" – in 1997 (Krchnak, 2007). The discussion that ensued, which involved EMAAP-Q, the municipal government, and other stakeholders, as well as evidence provided by the local electricity company that stream-flow was declining due to poor watershed management culminated in early 2000 in the establishment of the Fund for the Conservation of Water (FONAG). This *fideicomiso* was financed mainly by EMAAP-Q, which contributed 1 percent of its sales revenues, approximately equal to US$360,000 per annum. Additional monies were provided by the electricity company, a private brewery, and the Swiss Agency for Development and Cooperation (Krchnak, 2007).

FONAG's returns are to be used for activities such as the acquisition of land, the control of fires, fencing and other protection for springs, forest conservation, and the promotion of sustainable agriculture as well as monitoring and evaluation of projects. At the end of 2004, FONAG's balance was US$2,125,000 and, between interest earnings and other income, US$425,000 were available in 2005. In addition, counterpart funding of US$560,000 was attracted, which brought the overall budget for the year to $985,000 (R. Troya, personal communication, April 2007).

In a complete sense, FONAG does not constitute PES. To date, there have been no direct payments to private providers of environmental services. Obviously, conditionality is not an issue. Instead, payments from users of watershed services are being directed to conventional conservation projects.

The decision to set up a trust fund, rather than channeling current payments from EMAAP-Q's customers directly to field activities, delayed FONAG's impacts for a few years, which prompted complaints in some quarters. However, the financial soundness of this approach has helped to attract counterpart monies, including from TNC (Krchnak, 2007). Furthermore, the endowment continues to

grow, with the balance in December 2007 expected to be nearly US$5.0 million (R. Troya, personal communication, April 2007). As this growth happens, budgets for field activities will be augmented, which ought to enhance FONAG's profile and public support.

Finally, conclusive proof that FONAG's political footing is very sound is that the commitment EMAAP-Q made in 2000 to provide financial support recently became governmental policy. To be specific, Metropolitan Ordinance 0199, enacted on 2 March 2007, mandates that the share of the company's sales revenues will rise from the current level of 1 percent to 4 percent four years from now. Clearly, the buyer's side of PES is firmly established in Quito.

CASE STUDY 3
PAYMENTS FOR HYDROLOGIC-ENVIRONMENTAL SERVICES–MEXICO

Pimampiro has been a small-scale experiment with PES. FONAG benefits a much larger population, yet addresses resource use and management in a single drainage basin. In contrast, Mexico's Program for Hydrologic-Environmental Services (PSA-H), which was instituted in 2003 by the Ministry of the Environment and the National Forestry Commission (CONAFOR), has national coverage – the only initiative of its kind in Latin America besides the PSA Program in Costa Rica.

Whereas the latter encompasses four environmental goods and services – water, carbon, biodiversity, and scenic beauty – the PSA-H focuses on the conservation of threatened natural forests for the sake of maintaining the flow and quality of water. This emphasis reflects mounting water scarcity in Mexico as well as elevated deforestation in many parts of the country (Muñoz-Piña *et al*., forthcoming).

Funding for the PSA-H, which grew from US$18 million in 2003 to US$30 million in 2004, derives from charges paid by federal water users. Consistent with the Program's basic purpose, monies are disbursed to individual and collective (*ejido*) landowners possessing natural forests that serve watershed functions. A departure from the Costa Rican scheme, which features uniform levels of per-hectare reimbursement, is that payments for cloud forests (US$40/hectare/year) exceed those for other tree-covered land (US$30/hectare/year). This differentiation reflects the value of capturing horizontal precipitation in the former habitat.

PES Program – Costa Rica

Costa Rica, where cumulative deforestation is very advanced, pioneered the use of conservation payments in developing countries by establishing its Payments for Environmental Services (PSA) Program in 1997. Forest Law 7575 (1996) established four primary purposes for the Program: (1) mitigation of greenhouse gas emissions; (2) hydrologic services, including provision of water for human consumption, irrigation, and energy production; (3) biodiversity conservation; and (4) protection of scenic beauty for recreation and ecotourism. The same law established a regulatory framework for contracting with landowners for the provision of these services. It also established the semi-autonomous National Fund for Forest Financing (FONAFIFO) to manage the PSA.

To participate in the PSA Program, landowners submit a plan for sustainable forest management, prepared by a licensed forester. Once this plan is approved, specified practices (i.e. timber plantation, forest conservation or management) must be adopted, which triggers payments. In 2006, for example, annual payments for forest conservation averaged US$64/hectare. For forest plantations, approximately US$816/hectare are disbursed over a 10-year period. Recently, payments for agroforestry were added. Although an initial disbursement can be requested upon contract signing, all subsequent annual payments require verification of compliance.

To date, the PSA Program has been funded primarily with revenues from a national tax on fossil fuels, which averages about US$10 million per annum. Additional support has included two grants from the Global Environment Facility, a World Bank loan, and a grant from the German aid agency, KFW. In 2005, a new water tariff came into effect, which increased PSA revenues. In addition, new opportunities will be created as global carbon markets continue to develop.

The area enrolled in the PSA Program in late 2005 represented about 10 percent of the country's forests. The effects of payments on deforestation are difficult to pinpoint. Deforestation had leveled off during the early 1990s, prior to the Program's beginnings. An important reason was a decline in the cattle economy, which previously had accounted for most encroachment on tree-covered land. Almost certainly, the Program has affected land use since 1997, although existing data and a lack of monitoring make precise quantification impossible.

Regardless, the PSA Program is very popular with landowners, with requests to participate far outstripping available financing. Partly because it is built on previous forest subsidy schemes, it makes relatively uniform payments (fixed rates for each land-use category) and has a low degree of spatial targeting. One important finding from the Costa Rican program is the need to remain flexible and to adapt to lessons learned and changing circumstances, including differentiating payments and focusing efficiency.

Sources: Pagiola (forthcoming); Wünscher *et al*., (2006).

As in Costa Rica, contracts with suppliers of environmental services are for five years, with conditional renewal. Payments are made at year's end in cash, provided that compliance with contractual obligations has been satisfactory during the preceding twelve months. Compliance-monitoring is the responsibility of CONAFOR, which analyzes satellite imagery and carries out random and occasional field visits to detect changes from forest-cover baselines. If some but not all of a landowner's holdings are deforested due to the action of a third party (e.g., forest fires), then payments for that sub-area come to an end. But a landowner who deliberately clears any part of his enrolled holdings, to make way for new cropland or pastures for example, then the contract is rendered null and void and all payments cease.

The response of Mexican landowners to the program has been strong. The 2003 budget allowed for the enrollment of 126,000 hectares, although offers were received for 560,000 hectares (Bayon, 2004). In response to the gap between the budgeted area and applications, CONAFOR has worked with the National Water Commission (CNA) to identify forests that are important in terms of watershed protection or aquifer recharge and that are upstream from at least 5,000 water consumers. Prioritization also takes into account natural forests of good quality where commercial logging is not viable as well as biodiversity (e.g., the protection of unique habitats in mountainous settings). In addition, areas where the threat of deforestation is great, based on econometric analysis carried out by the Instituto Nacional de Ecología (INE), are supposed to be given high priority, as are zones with an elevated incidence of poverty.

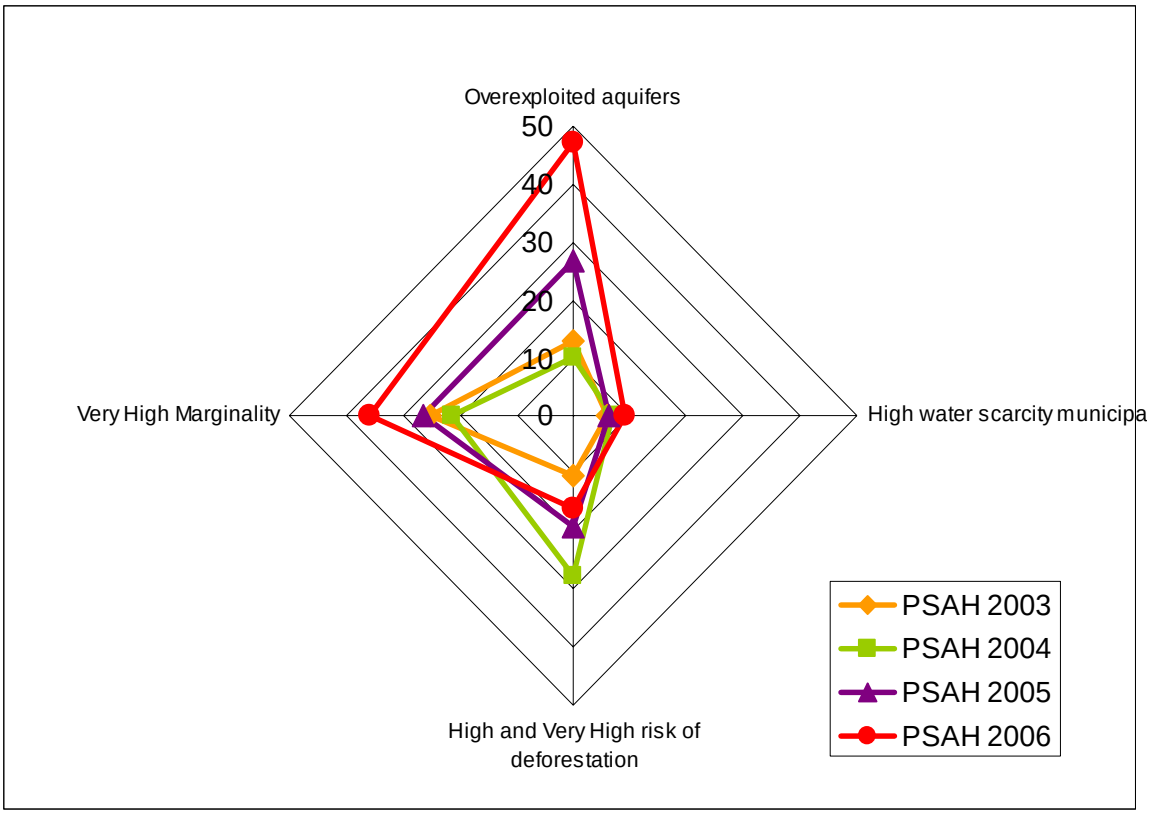
Relative weights assigned to these criteria have changed during the four years of PSA-H's existence. For example, the Program at times has had to satisfy different interest groups by giving more or less importance to poverty alleviation or biodiversity protection. All else remaining the same, this affects potential watershed benefits. Moreover, experience has allowed the spatial targeting of PES to improve over time (Muñoz-Piña *et al*., forthcoming). As indicated in Figure 3, the PSA-H has become much better at concentrating enrollment in the vicinity of over-exploited aquifers and somewhat better at addressing the needs of municipalities facing acute water scarcity. In addition, emphasis on marginalized areas where poverty alleviation is an important objective has increased. A more worrying trend is that conservation payments are now being directed less to places with the greatest deforestation risk. In 2006, for example, forests placed in the bottom quintile in terms of this risk were 43 percent over-represented in the group selected to receive conservation payments – up from 22 percent in 2004. The same year, just 6 percent of the forested tracts identified in the top quintile were enrolled, down from 11 percent in 2004 (Muñoz-Piña *et al*., forthcoming; C. Muñoz-Piña, personal communication, January 2007).

In part, these changes have to do with CONAFOR's original decision to focus on areas with low deforestation risk but with an elevated incidence of poverty. Obviously, landowners have an incentive to offer areas with modest (or even negative) opportunity costs to the PSA-H. As a bottom line, the PSA-H's overall service additionality, defined as the service-level potential times the probability of having an impact on land use, may actually have decreased over time, due to a greater inclusion of little or no risk of deforestation. The eventual effects on the quality and availability of water are difficult to estimate, since little hydrologic monitoring has been undertaken.

With respect to poverty alleviation, targeting places with high natural-forest cover is in itself a powerful pro-poor filter, since no less than two-thirds of these places are categorized as having a very high incidence of poverty. In 2003, 93 percent of enrolled areas were in *ejidos* and other rural communities (Alix-García *et al*., 2005), although within this group the poorest households were not as likely to participate as their neighbors. In 2006, 72 to 83 percent of PSA-H payments went to forests in settings characterized by high or very high poverty. In 2004, an INE survey showed that 31% of PSA-H beneficiaries had incomes below the poverty line, although the poorest of the poor were under-represented among payment-recipients. For impoverished households, PSA participation could raise incomes by up to 10% (Muñoz-Piña *et al*., forthcoming). For community-owned forests, PSA-H payments were often utilized to invest in village-level infrastructure (Alix-García *et al*., 2005).

With respect to sustainability of the scheme, the PSA-H is intended only to provide a temporary incentive for conservation in any given setting. The intention is for a transition to occur in all enrolled areas either to self-sustaining commercial forestry or to conservation paid for by direct beneficiaries within the watershed. The former sort of transition may often be unrealistic. For a transition to be made

Figure 3: Evolving Emphases of the Mexican PSA-H



to locally financed conservation – that is, to full-fledged, local PES – the Program's environmental services will have to be evaluated, in order to interest local buyers of these services.

What lessons has the Mexican PSA-H program provided so far? Compared to the Costa Rican system, it is more sophisticated in terms of targeting tools, which in principle gives it the potential to achieve more additionality. However, application of these tools so far has been heavily constrained by side-objective prioritization and political-economy obstacles to implementation, which is seemingly a quite common feature for national-level PES schemes. In addition, the program has experienced multiple changes between the design and implementation phases (Muñoz-Piña *et al*., forthcoming; Alix-García *et al*.,2005).

Recurrent transaction costs of the PSA-H have legally been limited to 4 percent of total transfers (not counting additional operational expenditures charged to the budget of the federal agency which implements the program), which means that cost shares are probably lower than in Costa Rica. This might indicate efficient administrative design, including the capture of scale economies. Nevertheless, low transaction costs seem at least in part to come at the cost of weaknesses in monitoring. In one region, Sierra Gorda Biosphere Reserve, it is reported that there is no effective control of over-grazing of enrolled forests, since in the short run canopy cover is not reduced; however, over-grazing for sustained periods degrades forests and compacts soils, thereby diminishing hydrologic functions (Bayon, 2004). Even CONAFOR's monitoring of land-use changes with satellite imagery recently has been proved superficial (C. Muñoz-Piña, personal communication, January 2007). There also has been some rent-seeking by communities engaged in commercial timber operations, which contrary to the original intentions of the PSA-H have enrolled their holdings and continue to receive payments due to gaps in monitoring.

In addition, some of the currently contracted conservation areas may be too fragmented over multiple watersheds to have significant hydrologic impacts (Alix-García *et al*., 2005). To date, the overall benefits of PSA-H implementation for water consumers may thus be less significant than those

received by poor service providers. Weaknesses in monitoring and the failure to focus on genuinely threatened areas are key issues to be addressed. As an underlying factor of accountability, a forestry institution like CONAFOR may not be the best representative of water consumers. The latter may need to be more directly involved in PSA-H implementation to ensure the desired hydrologic outcomes that, after all, constitute the Program's *raison d'être*.

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ANNEX

ALLEVED WATERSHED PES SCHEMES

A. SOUTH AMERICAN PROJECTS

Country	Sources**	Initiative	Status informed in source
Bolivia	1,2	Bermejo (area shared with Argentina)	Abandoned or discontinued
Bolivia	2	Comarapa Municipality	No detailed information
Bolivia	2,3	ICO, Sta. Cruz Department	Ongoing
Bolivia	2,3	Los Negros	Ongoing
Bolivia	2	San Pedro (GTZ)	Advanced proposal
Bolivia	2	Sucre (GTZ)	Advanced proposal
Bolivia	1,3	Tarija - PROMETA, Sama Reserve	Ongoing
Bolivia	2	Watershed management programme (GTZ)	Advanced proposal
Brazil	2	CPCJ riverban restoration	Ongoing
Brazil	2	Proambiente (Amazon basin)	Ongoing
Brazil	1,2,10	ICMS municipal tax incentives	Ongoing
Brazil	2	São João Watershed (WWF)	No detailed information
Brazil	1	SEMAE, São Paulo	None
Brazil	7	Semi-Arid Sertão GEF project	Advanced proposal
Chile	1	Water share trading	Abandoned or discontinued
Colombia	2	Afluentes del Cauca	Advanced proposal
Colombia	1	Campoalegre user association	Ongoing
Colombia	2	Fúquene Lake	Ongoing
Colombia	2	La Miel HEP	Advanced proposal
Colombia	2,10	CIPAV silvopasture LA Vieja	Advanced proposal
Colombia	1,10	Valle del Cauca irrigator payments	Ongoing
Colombia	10	Chaina water user payments	Ongoing
Colombia	1,4	CIF national watershed scheme	Abandoned or discontinued
Colombia	10	Santander & Boyacá Corridor Natura	Ongoing
Colombia	8	Guabas River irrigator payments	Ongoing
Ecuador	2,10	Ambato	Advanced proposal
Ecuador	2	Arenillas	No detailed information
Ecuador	2	Cotacachi, Imbabura	No detailed information
Ecuador	1,2,10	Cuenca water user payments	Ongoing
Ecuador	2	EcoFondo Podocarpus National Park	Advanced proposal
Ecuador	1,2,10	FONAG, Quito	Ongoing
Ecuador	9	El Chaco water users, CEDERENA	Ongoing
Ecuador	2	Pedro Moncayo	Ongoing
Ecuador	2,10	Pimampiro	Ongoing
Ecuador	2,10	El Angel	Advanced proposal
Ecuador	10	Celica, Loja – CEDERENA	Advanced proposal
Ecuador	10	Paute HEP – Nudo de Azuay conservation	Advanced proposal
Ecuador	2	Shutan Bajo	Ongoing
Peru	5	Alto Mayo (Cuencas Andinas)	Advanced proposal
Peru	5	Arequipa (Cuencas Andinas)	Advanced proposal
Peru	5	Jequetepeque (Cuencas Andinas)	Advanced proposal
Peru	2,5	Piura (Cuencas Andinas)	Advanced proposal
Venezuela	2	Partnerships for National Parks	Advanced proposal
Venezuela	6	Pereño/ La Jabonosa rivers, Táchira	Ongoing
Venezuela	7	Venezuelan Andes Project, GEF	Advanced proposal
Venezuela	7	Guri HEP payments to Canaima NP	Ongoing

B. MESO AMERICAN AND CARIBBEAN PROJECTS

Country	Sources**	Initiative	Status informed in source
Costa Rica	2	State Power producer (CNFL)	Ongoing
Costa Rica	2	Del Oro farmer payments	Abandoned or discontinued
Costa Rica	1,2	Energia Global, Central Plateau	Ongoing
Costa Rica	2	ICE (National Institute of Electricity)	Ongoing
Costa Rica	1,2	ICE-Arenal Watershed Fund	Abandoned or discontinued
Costa Rica	2	La Esperanza	Ongoing
Costa Rica	2	La Florida	Ongoing
Costa Rica	1,2	Platanar River, San Carlos	Ongoing
Costa Rica	1,2	San José Watershed Fund	Abandoned or discontinued
Costa Rica	1,2	Heredia Public Service Enterprise	Ongoing
Costa Rica	1	Monteverde Cloud Forests	None
Costa Rica	1,2	PSA National Program	Ongoing
Costa Rica	1	Norwegian purchase of carbon offsets and Costa Rican Power Company's purchase of improved water quality	Ongoing
Dominican Republic	2	PROCARYN pooled water resource conservation	Advanced proposal
Dominican Republic	7	Upper Sábana Yegua, GEF	Advanced proposal
El Salvador	2	Jaltepeque-Jiquilisco	Ongoing
El Salvador	2	Coatepeque	Ongoing
El Salvador	7,10	Ecoservicios (national program)	Abandoned or discontinued
El Salvador	1	El Imposible National Park	Ongoing
El Salvador	2	PASOLAC	Ongoing
Guatemala	2	Cerro San Gil	Ongoing
Guatemala	1	Montagua River, Sierra de Las Minas	Advanced proposal
Guatemala	2	MAGA national scheme	Ongoing
Guatemala	2	San Jerônimo (GTZ)	Ongoing
Honduras	2	Campamento, Olancho	Ongoing
Honduras	2,8	Sta Bárbara - El Escondido, Copán	Advanced proposal
Honduras	2	Jesus de Otoro	Ongoing
Honduras	2	Orica Creek (WWF/CARE/IIED)	Advanced proposal
Honduras	2	Rio Platano (GTZ)	Advanced proposal
Jamaica	2	Buff Bay	Advanced proposal
Jamaica	1	Watershed protection contracts and fees	Uncertain
Mexico	2	Copalita	None
Mexico	8	Lerma Chapala Basin	Pilot
Mexico	8	Triunfo Biosphere Reserve Chiapas	Pilot
Mexico	8	Coatepec, Veracruz	Proposed
Mexico	2	Fideicoagua	Ongoing
Mexico	2	National PSAH	Ongoing
Mexico	2	Pronatura	None
Mexico	2	Valle de Bravo	Ongoing
Mexico	2	Zapaliname	Ongoing
Nicaragua	2	San Pedro Norte	Ongoing
Panama	1,2,10	Panama Canal watershed reforestation	Advanced proposal
Panama	7	2nd Mesoamerican Corridor Project, GEF	Advanced proposal
Panama	2	Fito del Tallo hills, Darien	No detailed information
St Lucia	2	Talvem Watershed	Advanced proposal

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November 2007

Payments for Environmental Services: The PES Knowledgebase

Prepared by:

Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program (SANREM CRSP)

Office of International Research, Education, and Development (OIRED), Virginia Tech

E-mail: oired@vt.edu
On the Web: www.oired.vt.edu

Payments for Environmental Services Knowledgebase

October 2007

As part of the USAID/EGAT/NRM funded Payments for Environmental Services (PES) Associate Award, the SANREM CRSP Knowledgebase (SKB) was expanded to include information resources related to Payments for Environmental Services. In September 2007, the SKB contain metadata on approximately 160 significant PES and PES-like projects and 150 additional PES information resources (books, journal articles, reports, etc.). The following sections provide a brief overview of the SKB and then more details on PES specific metadata and how the SKB can be queried to identify PES information resources.

SANREM Knowledgebase

The SANREM Knowledgebase (SKB) is an on-line data base of "information resources" (books, reports, journal articles, videos, movies, presentations, etc.) produced or identified, classified, and summarized by SANREM CRSP researchers. The SKB provides on-line access to significant information resources relevant to sustainable agriculture and natural resources management. The database is searchable via fields such as: title, creator/author), creation date, keywords, media type, time period, location, description (abstract), language, and SANREM Project Number (if appropriate). The SKB is located on the SANREM CRSP website at: http://www.oired.vt.edu/sanremcrsp/menu_information/knowledgebase.php.

Information Technology Development: Application developers from Agriculture, Human and Natural Resources Information Technology (AHNR-IT) at Virginia Tech were enlisted to develop the SANREM Knowledgebase web application. The SANREM Knowledgebase was built using Apple's WebObjects development platform. WebObjects is a state-of-the-art Java based application server that is particularly well suited for designing complex, high traffic web applications. In addition to WebObjects, the SANREM Knowledgebase also uses the Oracle Database Management System. By using WebObjects in conjunction with Oracle, the SANREM Knowledgebase is able to provide fast, secure, and reliable data access to its clients. The SKB went on-line in the fall of 2005 and has been updated continuously to improve its functionality. It provides the ability for SANREM CRSP researchers to classify and catalog key SA and NRM information resources.

A researcher is granted the ability to login into the system by a SKB administrator and is given one of three levels of permission. The first level of permission, "cataloger", allows the researcher to enter resources or to view all resources in the system. To add a new resource, the researcher classifies the resource using a standard set of metadata. The Dublin Core Metadata Initiative (http://www.dublincore.net) defined the initial metadata elements in the SKB. An expanded list of key words specific to SA and NRM were then developed to guide and accelerate metadata entry and searches. The list of keywords is updated periodically. The researcher also has the option of uploading non-copyrighted resources to a central server to allow access to the resource via the Internet. Resources can be any type of file (PDF, Word, images, video, etc.).
As of Sept. 24, 2007, 1928 SANREM CRSP-generated information resources and other SA and NRM information resources have been cataloged and entered into the SKB.

The second level of permission is that of "reviewer". Reviewers have all the rights of "catalogers", as well as the right to review and edit the metadata other researchers. All resources submitted to the SKB by catalogers must be reviewed and approved by "reviewers" for quality control purposes before the resources are published and available to the public. Reviewers have the right to publish approved resources. Once a resource is published, it becomes available to the public through open access on the web. The final and highest level of permission is that of "administrator". The "administrator" has all the rights of catalogers and reviewers, as well as the ability to add or deactivate users or change user permission levels.

The general public has the ability to search the database for published resources. Resources may be searched by a number of different criteria including title, keyword, creation date, GPS location, and date of data collection, etc. Resources matching the given criteria are returned in a list format from which they can be inspected and downloaded if appropriate. Data entry and searches are facilitated by the SKB Metadata Guide available from the SKB website: http://www.oired.vt.edu/sanremcrsp/menu_information/knowledgebase.php

PES Specific Metadata

Entries for PES-related projects and resources in the SKB contain both standard knowledgebase metadata (e.g. "title", "creator," "description") and PES-specific metadata. Either or both of these may be used for searching the database.

The query webpage is accessible at:
http://www.ext.vt.edu/cgi-bin/WebObjects/SANREM.woa/wa/advancedSearch.

Searching for PES entries:

- To limit a search to PES-specific entries, use the "SANREM project id" drop-down list to select "**PES-1**" (this is located at the bottom of the webpage)
- You can limit your search to only **PES projects** by selecting "**project"** from the list of "Type" options, or limit your search to only **PES resources** by selecting "**text."** If you would like your search to include both projects and resources, you do not need to select either.

Searching by keywords:

Restricted keywords (general SKB and PES)

- The SKB has both a general keyword list and a PES-specific keyword list; both of these restricted keyword lists are used for PES entries. You will likely have the most success with your search if you locate the relevant keywords on the restricted lists.
- The keyword lists appear on the right hand side of the page (PES-specific keywords are at the bottom); click on the listed categories and they will expand to show the keywords for each category.
- Searching for multiple keywords is non-exclusive – your results will include entries with any of the selected keywords (i.e. selecting additional restricted keywords will increase, rather than decrease, the number of results).

PES Specific Keywords

- Climatic Zone
  - ☐ Alpine
  - ☐ Arid
  - ☐ Cold
  - ☐ Humid
  - ☐ Semiarid
  - ☐ Subhumid
  - ☐ Subtropical
  - ☐ Temperate
  - ☐ Tropical
- Ecosystem
  - ☐ Agricultural
  - ☐ Aquatic
  - ☐ Coastal
  - ☐ Coral Reef
  - ☐ Desert
  - ☐ Freshwater
  - ☐ Grassland
  - ☐ Island
  - ☐ Marine
  - ☐ Mountain
  - ☐ Natural Forest
  - ☐ Paramo
  - ☐ Plantation Forest
  - ☐ Riparian
  - ☐ Savanna
  - ☐ Shrubland
  - ☐ Tundra
  - ☐ Wetland
- Ecosystem Services Targeted/Benefiting
  - ☐ Air purification
  - ☐ Biodiversity
  - ☐ Carbon Sequestration
  - ☐ Climate regulation
  - ☑ Detoxification/decomposition of wastes
  - ☐ Drought control
  - ☐ Erosion control
  - ☐ Flood control
  - ☐ Genetic resources
  - ☐ Habitat
  - ☐ Minimum streamflow protection
  - ☐ Nutrient cycling
  - ☐ Pest control
  - ☐ Pollination
  - ☐ Protection from UV rays
  - ☐ Renewable energy
  - ☐ Renewable resources
  - ☐ Seed dispersal
  - ☐ Soil quality
  - ☐ Tourism & recreation
  - ☐ Water purification
  - ☐ Watershed services

Unrestricted / free text search

- Use the free text box at the top of the search page to enter any words you would like to search for. This can include a part of the title, the creator (individual or corporate), the geographic location, and keywords not found on the restricted list.
- This search function does not search the restricted keyword list (i.e., if you type in "biodiversity," it will not necessarily find entries for which "biodiversity" is selected as a restricted keyword.)
- You may add additional search terms by clicking the button "Add Search Criteria." Your search results will show only entries that match all of the free text search criteria you enter.

Searching by PES-specific search criteria:

- Click "**Display PES Specific Search Criteria**" (located toward the bottom of the query page)
- You may select multiple terms within a category; this will increase the number of results.
- Selecting terms from different categories will limit your search results to entries that include one of the selected terms from each of the categories.
- The PES search criteria are included below for your convenience.

The PES search criteria are:

- **Type of PES project**
  (proposal, feasibility or research project, implemented project)

- **PES Project Definition**:
  Voluntary transaction between PES buyers and sellers?
  Well-defined environment service?
  Well-defined and identified environmental service buyer(s)?
  Well-defined and identified environmental service provider(s)?
  Are payments to providers conditional on buyer securing environmental services?

- **Promoted Action**
  Poverty reduction (as a stated goal)
  Protection of existing environmental services
  Restoration/establishment of environmental services

- **Valuation Method (Cost Based)**
  Replacement costs
  Cost of providing surrogate services
  Damage cost avoided
  Valuation Method (Revealed Preference)
  Market Price Method
  Productivity approach
  Surrogate market approaches
  Valuation Method (Stated Preference)
  Contingent valuation
  Conjoint analysis
  Choice experiments

- **Provider Compensation Method**
  Cash payment to provider
  In-kind payment to provider
  Cash or in-kind payment to provider associations
  Support for the legalization of land-ownership titles
  Provision of social services and infrastructure
  Investment financing to improve land management
  Certificates and special product seals
  Technical assistance, training and marketing support
  Rural tourism and ecotourism community support
  Expansion of access or use rights to natural resources
  Violation of contract results in no payments
  Payments decrease with contract violation severity
- **Service Buyer**
  Hydroelectric
  Water utility
  Private sector
  Tourists or tourism operators
  Irrigators
  Land developers
  International conservation donors
  Intermediaries
  Government
- **Service Provider**
  Government
  Landowners
  Untitled landholders
  Parks/Reserves
  Community
  NGO
  Industry
- **Service Intermediaries**
  NGO
  Government
  Private
- **Measure of Service Provided**
  Direct measure (of quantity of service provided (tons, km, ha, m^2, etc.))
  Indirect measure (services provided (land use changes, contracts signed))

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USAID PES SOURCEBOOK APPENDIX

OCTOBER 2007

The USAID PES Sourcebook was prepared for USAID by the SANREM and BASIS CRSPs through the Global Assessment of Best Practices in Payments for Ecosystem Services Programs project. The views and opinions of the authors expressed herein do not necessarily state or reflect those of the United States Government.

This work is intended to be a living document that will be periodically updated and edited. Updates will be available from the project website. For more information or to send suggestions for changes and additions, see http://www.oired.vt.edu/sanremcrsp/pes or contact Michael Colby, USAID/EGAT/NRM, mcolby@usaid.gov

Sustainable Agriculture and Natural Resources Management CRSP
Office of International Research, Education, and Development
Virginia Tech
526 Prices Ford Rd,.Blacksburg, VA 24061
Phone: 540-231-6813
Fax: 540-231-1402
Email: sanrem@vt.edu
On the web: www.oired.vt.edu/sanremcrsp/